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Bulletin of the
University of
New Hampshire

Under-graduate Catalog

University of New Hampshire

Undergraduate Catalog

1983–84

University Calendar 1983–84

Summer Session 1983

May 31 to August 19

Semester I

August 27, Saturday
9 a.m. Residence halls open for freshmen

August 28, Sunday
9 a.m. Residence halls open for upperclassmen
Registration for new students

August 29, Monday
Registration for continuing students

August 30, Tuesday
8 a.m. Classes begin; hold Monday schedule

September 5, Monday
Labor Day holiday—no classes

September 6, Tuesday
Last day to withdraw and qualify for ¾ tuition refund
Graduate student registration

September 9, Friday
Last day to drop courses without $10 late drop fee

September 16, Friday
Last day to add courses without dean's approval and without $10 late add fee
Last day to choose pass/fail grading alternative

September 28, Wednesday
Last day to withdraw and qualify for ½ tuition refund

October 21, Friday
Midsemester, last day to drop courses; withdraw without academic liability; to resolve previous semester's "incomplete" grades
Last day to carry more than 20.0 credits without surcharge

November 11, Friday
Veterans Day holiday—no classes

November 23, Wednesday
Classes hold Friday schedule

November 24–25, Thurs.–Fri.
Thanksgiving holidays—no classes

November 28, Monday
Classes resume

December 12, Monday
Reading Day

December 13, Tuesday
Final exams begin

December 17, Saturday
Final exams end

December 18, Sunday
Commencement 2 p.m.

Semester II

January 15, Sunday
9 a.m. Residence halls open

January 16–17, Mon.–Tues.
Registration days

January 18, Wednesday
8 a.m. Classes begin

January 23, Monday
Graduate student registration

January 24, Tuesday
Last day to withdraw and qualify for ¾ tuition refund

January 27, Friday
Last day to drop courses without $10 late drop fee

February 3, Friday
Last day to add courses without dean's approval and without $10 late add fee
Last day to choose pass/fail grading alternative

February 16, Thursday
Last day to withdraw and qualify for ½ tuition refund

March 12–16, Mon.–Fri.
Semester break

March 19, Monday
Classes resume

March 23, Friday
Midsemester. Last day to drop courses or withdraw without academic liability; to resolve previous semester's "incomplete" grades
Last day to carry more than 20.0 credits without surcharge

May 9–10, Wed.–Thurs.
Reading Days

May 11, Friday
Final exams begin

May 13, Sunday
Thompson School graduation 2 p.m.

May 17, Thursday
Final exams end

May 18, Friday
Senior Day

May 19, Saturday
Commencement 10:30 a.m.

Summer Session 1984

May 21 to August 10

The University reserves the right to modify the calendar subsequent to printing.

Contents

The first half of this bulletin explains the University's General Education Requirements and requirements for a degree, describes programs offered in the University's colleges and schools, and gives information about majors and the requirements for them. Special University programs that cut across traditional college lines are explained at the end of this first section. This first half also provides general information about admission, student affairs, and costs.

The second half of the bulletin describes individual courses. (Note explanation of arrangement on page 91.) The section concludes with a listing of faculty, as well as other items noted in the contents.

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For information about undergraduate admission to the University, students should contact: Stanwood Fish, Director of Admissions.

For information about courses and academic records, students and former students should contact: Stephanie M. Thomas, Registrar.

General Information

The University

History

The University of New Hampshire, founded in 1866 as the New Hampshire College of Agriculture and the Mechanic Arts, was among the early state institutions of higher education whose formation was made possible by federal government land grants to establish colleges to serve the sons and daughters of farming and laboring families.

First situated in Hanover as part of Dartmouth College, New Hampshire College moved to its present campus in Durham in 1893 after Benjamin Thompson, a prosperous farmer, bequeathed land and money to further the development of the College.

The College thrived in Durham, and in 1923 the state legislature granted it a new charter as the University of New Hampshire, composed of the Colleges of Agriculture, Liberal Arts, and Technology. The Graduate School was formally added in 1928. The two-year program in agriculture, which had been offered since 1895, was formally recognized in 1939 and is now the Thompson School of Applied Science. The Whittemore School of Business and Economics was established in 1962.

In 1963, the University System of New Hampshire was created when the teachers' colleges at Plymouth and Keene were brought under the same Board of Trustees as the University. In 1969, the state legislature recognized the extended functions of the College of Agriculture, renaming it the College of Life Sciences and Agriculture, and the School of Health Studies was established as part of the University's programs. Beginning in 1971, the Division of Continuing Education was authorized to offer Associate in Arts degree programs as an additional approach to higher education for New Hampshire residents. In 1975 the College of Technology was renamed the College of Engineering and Physical Sciences.

Since 1967, the University has provided a widening range of undergraduate and graduate studies through its program at the Merrimack Valley Branch in Manchester. In 1977, the legislature recognized the branch as the Merrimack Valley College, the fourth campus in the University System. In 1972, the School of Continuing Studies was created to coordinate the off-campus educational programs of the University System institutions and to carry instructional services to communities throughout New Hampshire. In 1979, this school of the University System was renamed the School for Lifelong Learning.

In the 1982–83 academic year, the University had 10,622 degree candidates enrolled, including 481 in the Associate in Applied Science program of the Thompson School and 107 in the Associate in Arts program in the Division of Continuing Education. In the Division of Continuing Education, 1,441 special students also were enrolled.

Academic and cultural resources of each campus are amplified through System-shared programs and facilities. Cooperative ventures among the 12 member institutions of the New Hampshire College and University Council combine public and private higher education resources.

Campus

The home of the University is Durham, near the seacoast of New Hampshire—one of the oldest towns in northern New England. The town is semi-rural and still retains traces of its colonial past.

The campus, 188 acres in size, is surrounded by more than 3,000 acres of fields, farms, and woodlands owned by the University. A stream flowing through a large wooded area in the middle of the campus enhances the natural open space among the buildings—60 for teaching, research, and service, and 30 residence halls for men and women.

University Library houses 818,949 volumes, 6,477 periodicals, 7,272 tapes and records, and a substantial microfilm collection. Specialized subject collections in chemistry, engineering and mathematics, biological sciences, and physics are housed in four branches administered by a physical sciences librarian and a biological sciences librarian.

Athletics-Physical Education facilities include indoor and outdoor swimming pools; tracks and courts; gymnasia; weight training, wrestling, and gymnastics rooms; a dance studio; a number of playing fields; and an indoor ice rink.

Memorial Union Building contains student activities offices, auditoria and meeting rooms, food services, games and craft areas, and lounges.

Paul Creative Arts Center, home of the departments of the arts, music, and theater and communication, contains two theaters and two art galleries.

Thompson Hall, the main administration building, is an official historic landmark.

College Woods includes 5 miles of well-kept paths through 260 acres of woods.

The New England Center, a cooperative effort by the six state universities of New England to offer outstanding continuing education programs, provides modern facilities for adult education conferences and seminars in its residence-dining-learning center.

John S. Elliott Alumni Center, completed in 1977, houses the alumni and development offices and serves as a focal point for alumni activities and campus meetings.

The University's Computing Facilities operate virtually 365 days a year, 24 hours a day. They include large DECsystem-10s, VAXs, and PRIMEs, plus numerous microcomputers.

Teaching, Service, and Research

The University of New Hampshire is committed to offering excellent educational programs and opportunities for its students. The University's approximately 605 full-time teaching faculty provide a ratio of one full-time faculty member to about 17 full-time students. Eighty percent of the full-time faculty hold doctoral or terminal degrees, and many have earned national and international reputations in their professional fields.

A faculty member's first responsibility is teaching students. In the tradition of the nation's land-grant colleges, the University also encourages its faculty to contribute to the growth of human knowledge through scholarly research and service to the community beyond the campus.

Accreditation

The University of New Hampshire is accredited by the New England Association of Schools and Colleges, Inc., which accredits schools and colleges in the six New England states. Accreditation by the association indicates that the institution has been carefully evaluated and found to meet standards agreed upon by qualified educators. Specialized programs of study are also accredited by various professional organizations.

The University of New Hampshire supports the efforts of secondary school officials and governing bodies to have their schools achieve regional accredited status to provide reliable assurance of the quality of the educational preparation of its applicants for admission.

Admissions

Interviews and Campus Visits

Candidates are encouraged to contact the Admissions Office to arrange an interview with a student admissions representative. These representatives are qualified to give information about the academic organization of the University and the criteria used by the Admissions Committee in reviewing candidates, and they are best able to discuss student activities, living arrangements, and other aspects of UNH life. A professional staff member oversees each day's interview activity and is available to assist candidates with special concerns or questions. The University welcomes visitors to the campus and conducts scheduled tours. Also, frequent Saturday morning Group Information Sessions led by an Admissions Office staff member and student representatives are followed by guided tours of the campus. Please call the Admissions Office for information about dates and times.

Admissions Criteria

Admission to a bachelor's degree program is based upon successful completion of a four-year secondary school program of college preparatory coursework. Primary consideration is given to academic achievement and aptitude, as demonstrated by the quality of candidates' secondary school course selections, rank in class, recommendations, and the results of a College Entrance Examination Board Scholastic Aptitude Test. Consideration is also given to character, leadership, initiative, and special aptitudes and talents.

The choice of secondary school program and courses may limit or enhance opportunities and achievements in college. Candidates are strongly encouraged to extend their knowledge and learning skills through work in the basic academic disciplines. Most successful candidates present at least four years of English, three years of college preparatory mathematics, three years of foreign language, two years of laboratory science, and two years of social science. Successful candidates have generally completed three years of study in a single foreign language or have completed more than one year of study in each of two different languages.

Candidates are expected to pursue in greater depth those fields in which they have special interests. For example, students who plan to specialize in engineering, science, mathematics, or forestry are advised to present four years of mathematics including trigonometry, as well as laboratory coursework in chemistry and/or physics. For students planning to major in health-related disciplines, secondary school laboratory courses in biology and chemistry are strongly recommended.

The number of out-of-state students admitted to the University each year is limited. These candidates are asked to indicate their "prospective majors" on their application forms and will be considered for admission in competition with other out-of-state candidates applying for the same programs.

Candidates may apply for general admission as "Undeclared" applicants for the College of Liberal Arts, the College of Life Sciences and Agriculture, and the School of Health Studies. Applicants who have identified academic fields of interest are asked to indicate their "prospective" majors in order that the University may evaluate their credentials in terms of their academic objectives and avoid excessive enrollments in professional programs with fixed capacities.

Approximately 60 percent of the University students request a change in major during their undergraduate years, and approximately 90 percent of such requests are approved each year. These changes are possible after a student has been at the University for a semester and has secured permission from the appropriate college dean and department chairperson. However, it is important to realize that the University cannot honor all requests for such changes; at present this is true for programs in administration, computer science, and the engineering fields.

Admissions Tests Requirements

All candidates for admission to bachelor's degree programs are required to submit the results of a College Entrance Examination Board Scholastic Aptitude Test. While achievement tests are not required, successful scores on the Foreign Language Achievement Tests may enable an applicant to satisfy the foreign language requirement of the Bachelor of Arts degree programs. Other achievement tests are strongly recommended for candidates to the College of Engineering and Physical Sciences, the College of Life Sciences and Agriculture, and the School of Health Studies in the areas generally related to the student's prospective major.

Art and Music Candidates

Candidates applying for the arts major studio option or for the Bachelor of Fine Arts program are required to submit a portfolio. There is no portfolio requirement for those entering the art history option of the arts major. Candidates applying for programs in the Department of Music must make arrangements with the department chairperson for an audition. Chairpersons of both the arts and music departments may be reached at the Paul Creative Arts Center.

Freshman Admission Application Deadlines

Except for early notification candidates, applications should be submitted after the first marking period grades are available and before February 1. Applications received after that date may be considered only as vacancies occur. A nonrefundable application fee, $10 for New Hampshire residents and $25 for nonresidents, must accompany the application.

Early Notification

Between September 15 and December 15, the University is willing to consider well-qualified freshman applicants who desire fall enrollment under the early notification program. While it is not necessary that UNH be the first choice college, applicants should have carefully matched their objectives with the University's offerings and feel confident that their goals could be met at UNH. The University's early notification program places no obligation on the applicant to enroll if accepted for admission. The benefits for the successful early notification applicant are an early resolution of the question of admission to the University and priority with reference to the selection of a University residence hall if the student ultimately chooses to enroll. Unsuccessful early notification applicants will be reconsidered in the regular admissions process after receipt of senior year first marking term grades. Early notification applicants must submit a regular application, secondary school record, the results of a Scholastic Aptitude Test, and a counselor's letter of recommendation. Decisions will be returned by January 15 on all early notification candidates who have observed the application deadline.

Deferred Admission

The University considers applicants for deferred admission, which enables students to reserve a space in college while taking time off from school for work or travel. The University may not be able to offer deferred admission in certain program areas, however.

Advanced Standing

The University will recognize unusual secondary school work by means of advanced placement and credit for those who have taken enriched or accelerated courses before entering college. Applicants qualify for such credit by satisfactory achievement on University-approved placement examinations, including the College Board Advanced Placement Tests, or through the College Level Examination Program (CLEP). Further information may be obtained from the Admissions Office.

Associate Degree Candidacy

The University accepts candidates for Associate in Applied Science and Associate in Arts degree programs who have demonstrated ability and motivation for learning through secondary school achievement, work experience, and/or military service.

Both New Hampshire residents and out-of-state students may be considered for admission to Associate in Applied Science degree programs offered by the University's Thompson School of Applied Science. Candidates applying from the senior year in high school must submit the results of a College Entrance Examination Board Scholastic Aptitude Test. Students granted freshman admission to the Thompson School will be eligible for University residence hall accommodations. Two of the programs offered by the Thompson School, forest technology and civil technology, require that candidates present a minimum of two years of college preparatory mathematics (see also Thompson School chapter).

The University offers an Associate in Arts degree program through the Division of Continuing Education. While this program is available to both New Hampshire residents and out-of-state students, Associate in Arts degree candidates are not eligible for University residence hall housing, because of space limitations (see also Associate in Arts chapter).

Eligibility for Degree Candidacy

Applicants who meet the appropriate requirements for admission may become candidates for any undergraduate degree offered by the University. However, applicants having a degree will not be admitted into a program of study that awards the same degree (e.g., B.A., history, and B.A., zoology). Applicants may, however, be admitted into a program awarding a different degree (e.g., B.A., history, and B.S., biology; or B.A., history, and A.A.S., business management).

Readmission

An undergraduate who withdraws, does not register for UNH coursework in a given semester, or is suspended or dismissed from the University thereby terminates degree candidacy and must apply for readmission by the following deadlines: fall semester, July 1; spring semester, November 1. A nonrefundable application fee of $10 must accompany this application. Before seeking readmission, suspended students must remain away from school for at least one semester. The applications of suspended students are referred to the appropriate college dean and should include evidence that the applicant is ready to resume University work. Only under extraordinary circumstances will students be readmitted after having been dismissed for academic reasons. Applications submitted by dismissed students must be reviewed by the University's Academic Standards and Advising Committee. Students applying for readmission should realize that it may not be possible to enroll in certain programs that have established enrollment limitations, and no assurance can be offered that University housing will be available.

Transfer Students

The University will consider qualified candidates desiring to transfer from approved institutions. Transfer credit is awarded for courses that have

been completed with a grade above the lowest passing grade, provided those courses are comparable to courses offered at the University of New Hampshire. The University encourages competent applicants who have valid and legitimate reasons for desiring a transfer to UNH; however, it cannot encourage applicants with a history of academic or personal difficulty. Students who have encountered such difficulty are usually better advised to return after an appropriate period to their former college and improve their records before attempting to transfer.

Students enrolled in one of the University's associate degree programs who desire admission to a bachelor's degree program at UNH must apply as transfer students through the Admissions Office. A recommendation from the associate degree adviser is also required.

Transfer applicants should realize that it may not be possible to enroll in certain programs that have established enrollment limitations, and no assurance can be offered that University housing will be available.

Students desiring to transfer for the fall semester must complete application procedures before March 1; for spring semester, by November 1.

No portion of students' grade-point averages may be transferred; that is, external averages will not be calculated in the ones earned by students after entering UNH.

New England Regional Student Program

The University participates in the New England Regional Student Program of the New England Board of Higher Education, in which each state university in New England offers a number of regional curricula at the undergraduate level to students from other New England states. Under this program, students receive preferential admission consideration and, if admitted, pay the UNH in-state tuition plus 25 percent. Students must indicate on the application the specific approved curriculum for which they are applying. Information about the curricula may be obtained from the New England Board of Higher Education, 68 Walnut Road, Wenham, Mass. 01984.

Special Student Status

UNH offers the special student classification for persons who wish to participate in University coursework without entering degree programs. Special (nonmatriculated) students register for coursework through the University's Division of Continuing Education and are usually restricted to part-time study (maximum of 11 semester hours) unless permission is granted by the Admissions Office to exceed this limit. Special students have full access to the academic counseling services of the division and should realize that their continuing participation in University coursework is predicated upon satisfactory achievement. Non-UNH courses taken by a special student are not accepted as courses taken in residence.

Rules Governing Tuition Rates

All students attending any division of the University of New Hampshire in any capacity shall be charged tuition at a rate to be determined by their domicile. Those domiciled within the state of New Hampshire shall pay the in-state rate. Those domiciled elsewhere shall pay the out-of-state rate.

Students are classified as residents or nonresidents for tuition purposes at the time of admission to the University. The decisions, made by the director of admissions, are based upon information furnished in students' applications and any other relevant information.

All applicants living in New Hampshire are required to submit a notarized statement to the effect that their parents have been legally domiciled in New Hampshire continuously for a period of at least twelve months immediately prior to registering for the term for which the students are claiming in-state status. Students admitted from states other than New Hampshire or from foreign countries are considered nonresident throughout their attendance at the University unless they have acquired bona fide domicile in New Hampshire.

If students maintain residency apart from that of their parents, they must clearly establish that they are financially independent and that their residence in New Hampshire is for some purpose other than the temporary one of obtaining an education at the University. To qualify for in-state status, students must have been legally domiciled in New Hampshire continuously for a period of at least twelve months prior to registering for the term for which in-state status is claimed.

The burden of proof in all cases is upon the applicants. In all cases, the University reserves the right to make the final decision concerning resident status for tuition purposes.

A copy of the University's rules governing tuition rates may be obtained from the Admissions Office.

Student Affairs

The Division of Student Affairs provides a broad range of student services and programs to supplement the academic programs of the University.

The division includes the Dean of Students Office (including Handicapped Student Services); Residential Life (residence halls, family student housing, and dining services); Student Activities/ Memorial Union; Health Services; Counseling and Testing Center; Career Planning and Placement Service; Financial Aid; and Parents' Association coordination.

The division annually publishes a student guide, which includes statements of privacy rights as required by the Family Educational Rights and Privacy Act of 1974.

Dean of Students Office

The Dean of Students Office has major responsibility for the quality of student life on campus. The

staff has a working knowledge of the entire University (policies, procedures, and people) and interacts regularly with students, staff, faculty, trustees, and other persons who are interested in or involved with what is happening at UNH.

Within the Dean of Students Office are the following areas of responsibility: judicial affairs, Freshman Orientation (summer), Training in Academic Skills Center, Fireside Program, Freshman Council, Domestic Exchange Programs (California Exchange, North Carolina Exchange, and New England Subdegree Exchange), women's issues, international students, nonacademic policies and procedures, division research, handicapped student services, and Commuter/Transfer Center. Students and others are encouraged to contact the Dean of Students Office whenever they have a question, concern, or problem involving University life.

Handicapped Student Services Students with a physical or mental disability that limits one or more major life activities, such as walking, seeing, hearing, speaking, working, or learning, are encouraged to inform the Office for Handicapped Student Services, Room 101, Huddleston Hall, of the enabling accommodations they require.

The University encourages disabled members of its community to use existing services and to become involved in the mainstream of campus life. Inquire through the Office for Handicapped Student Services for information about priority scheduling, accessible classrooms, special parking arrangements, assistance in securing academic aids, accessible on-campus transportation, reading services, interpreters, and other special arrangements.

Commuter/Transfer Center The Commuter/Transfer Center, located in the Memorial Union, helps commuters and transfers cope with off-campus living. The staff can answer questions about renting, area landlords, consumer issues, and other commuter-related problems.Lists of available rental houses, apartments, rooms, and names of people looking for roommates are published weekly.

Other services include Transfer Orientation, car pooling assistance, a ride board, shared responsibility for a newsletter, lunchtime lecture and arts series, babysitting pool for student parents, etc. Typewriters are available for student use.

The commuter lounge and dining area adjacent to the center are gathering places for commuters to meet friends, chat, relax, or study.

Training in Academic Skills (TASk) Center The staff of the TASk Center provides instruction in reading and study skills, including exam preparation techniques. Academic-related advising and referral are available; subject area tutoring is provided to eligible students.

Residential Life

The Department of Residential Life is committed to providing a living environment that maintains high standards of health and safety and a learning environment that supports the total educational experience.

Residence Halls Undergraduate University housing is limited to full-time degree candidates; Associate in Arts degree and Division of Continuing Education students are not eligible for on-campus housing. Students are not required to live on campus. University housing is not guaranteed for the full four-year undergraduate period.

Applications for housing are sent to accepted freshmen and must be returned with the $100 housing deposit. Freshmen are guaranteed housing as long as the specified housing application deadline is met. Transfer and readmitted students are not guaranteed housing. However, they are encouraged to place their names on the housing waitlist with the Department of Residential Life.

The University reserves the right to adjust room and board charges and policies when necessary; however, such adjustments will be announced as far in advance as possible. Additional information about residence halls and dining services is available through the Office of Residential Life.

Dining University policy requires that undergraduate students living in residence halls board in UNH dining halls.

Students living off campus may purchase a 19-, 13-, or 5-lunch semester dining plan or a 35-meal commuter plan. Single meals may be purchased in the dining halls or at the Memorial Union cafeteria.

The dining halls offer a broad range of menu selections, enabling the diet requirements of most students to be met. However, a student with unusually restricted menu requirements because of medical prescription or religion should inquire with Dining Services as to whether these special needs can be met by dining hall menus.

Residence halls are not equipped for meal preparation. Students who prefer to prepare their own meals should seek off-campus accommodations with good kitchen facilities.

Student Activities/Memorial Union

The Office of Student Activities in the Memorial Union serves as the center for cultural events, student organizations, and related activities. It provides a wide variety of services and programs for the entire University community.

Student Activities Serving as a programming resource for students and other members of the community, the office provides administrative coordination for campus-wide events and operates the Memorial Union as an integral part of the University.

Students participate in approximately eighty recognized organizations, each with special interests, which include academics, politics, religions, careers, service, and social fraternities and sororities. Staff support is available to students in developing a new organization, leadership, programs, and activities. A Student Activities Fee, determined by the Student Senate, provides funds for: *The New Hampshire*, the student newspaper; WUNH-FM, the student radio station; *The Granite*, the UNH yearbook; the Student Television Network; Student Senate; Student Press; Cool-Aid, the campus crisis

referral service; the student lawyers; and two programming organizations, the Memorial Union Student Organization (MUSO) and the Student Committee on Popular Entertainment (SCOPE); and other organizations. Additional funds are available on request to other organizations for special programs.

Programs range from lectures, concerts, films, and educational seminars to special events like Parents' Weekends, Homecoming, the Christmas Crafts Fair, Winter Carnival, and spring dances.

Memorial Union As the University's community center, the Memorial Union serves as the focus for student programs and provides services for the entire University community. Students, faculty, and staff on the Memorial Union governing board work with the director to set policies for the operation of the building and those student activities related to the building. Building services include the University Information Center and Ticket Office, the Cat's Closet Store, a crafts center, a scheduling office for room and facility reservations, and a food service operation consisting of a cafeteria, Pistachio's Sweet Shoppe, pub, and catering service. The games area on the lower level of the building has candlepin bowling lanes, pool and billiard tables, pinball machines, and table tennis tables. The Commuter/Transfer Center and lounge provides a focal point for commuter students.

Health Services

The University Health Services located in Hood House provide comprehensive primary health care, including: laboratory examinations, X rays, physical therapy, pharmacy services, and limited mental health care. Both inpatient and outpatient care are available. The staff maintains close relationships with other specialists in the area to whom they may refer patients when medically indicated. Three well-staffed and equipped community hospitals are located nearby, and an emergency ambulance service is available in Durham at all times.

During the regular academic year, the Health Service is staffed by full-time physicians, adult registered nurse practitioners, nurses, and part-time consultants. Appointments with physicians and nurse practitioners may be made upon request. An appointment is not necessary for medical problems requiring immediate attention; such cases are treated through the outpatient clinic on a walk-in basis.

A mandatory health fee is assessed all undergraduate and graduate degree candidates and all full-time non-degree candidates. The academic year 1982–1983 health fee was $68. Payment of the fee entitles the student to unlimited visits to Health Services physicians, nurse practitioners, and clinic nurses; unlimited routine X rays and laboratory procedures performed at Health Services; health educator visits; cold clinic self-care medicines; the first $50 of off-campus laboratory work when it is ordered, and the specimen is collected, by a Health Services staff member for transmittal to the Health Services laboratory contractor; medicines for treatment of acute illnesses and injuries if the medicine is stocked in the Health Services pharmacy; family planning services; physical therapy; one visit to the orthopedic consultant each semester; one physical examination except for routine exams without specific purposes and those in lieu of the Data Acquisition for Student Health (DASH) form; and one day inpatient care in the infirmary each semester.

Services not included under the health fee are: medicines for treatment of chronic illness; X rays performed outside of the Health Service; off-campus laboratory tests performed by the Health Service laboratory contractor in excess of the first $50 and laboratory tests performed in any other laboratory (e.g., Wentworth Douglass Hospital, Leary Lab, etc.); contraceptive devices or medicines; emergency room visits or visits to any other health care facility or person, including physician office visits and emergency room visits ordered by the Health Services staff. An optional student accident and sickness insurance policy is available through Health Services. Its cost is moderate ($77 for a full year in 1982–83), and it covers most health care needs not covered by the health fee, including major medical payments. It is specifically designed to work in conjunction with the student health fee and may supplement or replace other insurance.

Health Record Requirement In order to provide effective health service, the University requires that students who have been formally accepted for bachelor's or associate degree candidacy and who register for nine or more semester credit hours must have complete medical records on file with the University Health Service. These records consist of a special health form furnished before registration. Students wishing exemption from this requirement on religious grounds must make a written request to the medical director of the University Health Service. It is the responsibility of students to complete the form before the beginning of classes. Any students failing to submit the completed form will not be allowed to register for classes in the subsequent semester.

Counseling and Testing Center

The Counseling and Testing Center offers students, without charge, professional counseling assistance in meeting a variety of personal, educational, and vocational problems. Services include individual and group counseling, vocational testing, and information on national testing programs such as the Graduate Record Examination. Counseling is available for special need or minority students, reentering women, and handicapped students. Individual clinical testing is available when indicated.

The staff is committed to the welfare and development of UNH students. The center sponsors a variety of student-oriented activities; e.g., personal skills groups on such topics as communication, values clarification, and life planning. The staff is available for consultation with faculty, administrative staff, and parents on matters relating to the welfare of students.

All information about a student's visits to the Counseling and Testing Center is confidential and cannot be released to anyone without the permission of the student.

Career Planning and Placement Service

The Career Planning and Placement Service assists students in planning for careers. The assistance available to students includes an on-campus interview program, which brings recruiting personnel to the campus between November and April; a library of information on employers and career opportunities; career/life counseling; a career development workshop series; and aid in finding summer employment. The service is available to all undergraduates; early use is encouraged.

College Council Placement Office The College Council Placement Office (CCPO) is a student service program funded by the New Hampshire College and University Council, of which UNH is a member. Students are encouraged to take advantage of this supplementary resource. The CCPO may be contacted directly at its Manchester, New Hampshire, office or through the University's Career Planning and Placement Service.

Financial Aid

The University Financial Aid Office assists promising students who are unable to meet educational expenses entirely from their own family resources. Aid is available in the form of grants and scholarships, loans, and part-time employment. The financial aid issue of the *Bulletin of the University of New Hampshire* contains specific program information, and a financial aid brochure gives application procedures and deadlines.

In many communities, scholarships and loans are available locally. School principals and guidance counselors have information about these sources of assistance, which are available both to high school seniors and adult students.

Before applicants may be considered for assistance by the University, two forms must be submitted: the UNH Application for Financial Aid and the Financial Aid Form. New Hampshire applicants may obtain these forms from their high schools or from the UNH Financial Aid Office. Nonresidents and transfer students may obtain the UNH application form from the Financial Aid Office and the Financial Aid Form from that office or from their local high schools. Upperclass applicants may obtain both forms from the Financial Aid Office.

Students should meet the following priority deadlines and should not wait until being admitted to the University before applying for financial aid:

Undergraduate Students: February 15
Graduate Students: May 1 (For NDSL, UNH loans, and College Work-Study; for information about other aid for graduate students, refer to the Graduate Bulletin.)

Grants and Scholarships

Admitted undergraduate degree candidates who will attend UNH on a full- or part-time basis may be considered for tuition grants and University scholarships. The basic consideration is financial need, although some scholarships are awarded on the basis of scholastic attainment, participation in extracurricular activities, or meeting specific requirements of a donor.

The University participates in the federally sponsored Supplemental Educational Opportunity Grant Program, which is designed to assist needy students who are admitted degree candidates.

Pell Grant Program

Students may apply directly to the federal government for a Pell Grant by utilizing the appropriate section of the Financial Aid Form or by completing a separate application available in the Financial Aid Office or from high school guidance counselors. Students must reapply each year for a grant.

Loan Programs

Two loan funds are administered by the University: UNH Loan Fund, and National Direct Student Loans. Admitted undergraduate and graduate degree candidates who will attend the University on an at least half-time basis may be considered for these loans. Financial need must be clearly demonstrated, and loans may be used only for educational expenses.

Most states now have higher education loan plans established by the Higher Education Act of 1965. Contact your local bank, other lender, or the Financial Aid Office for information about these loans.

Part-Time Employment

The College Work-Study Program, both academic year and summer, assists students who, as determined by the Financial Aid Office, need financial assistance for their educational expenses. Admitted undergraduate and graduate degree candidates attending at least half time are eligible for consideration.

Students who do not qualify for the College Work-Study Program may find part-time employment on or near campus.

Fees and Expenses

The cost for the freshman year at the University averages about $4,850 for residents of New Hampshire and about $7,950 for nonresidents.

Tuition

Tuition is $1,750 ($4,850 for nonresidents) per academic year. Undergraduates registering for 12 credits or more per semester pay the full tuition.

Students are permitted to enroll for more than 20 credits only with the approval of their college or school dean. After midsemester, persons carrying more than 20 credits will be billed a per-credit fee of $55 for each credit above 20 for resident students and $150 for nonresident students, whether or not a student has obtained the dean's approval. (No refund will be made if a student subsequently drops a course, bringing the credits to 20 or fewer.) Resident undergraduates registering for fewer than 12 credits pay $55 per credit hour, plus a registra-

tion fee of $5 per semester. Nonresident undergraduates registering for fewer than 12 credits pay $150 per credit hour, plus a registration fee of $10 per semester. The minimum charge for any recorded course is $55 for residents and $150 for nonresidents.

All students who are admitted to the University must pay an enrollment fee—$100 for residents and $250 for nonresidents—plus a nonrefundable administration fee for both residents and nonresidents. Only the enrollment fee will be credited on the tuition bill. If a student decides not to attend the University, these payments may be refunded on a prorated basis until July 1, according to the guidelines set by the admissions office.

Three-fourths of tuition charges will be refunded to students withdrawing or dropping courses within one week of registration; one-half after one week and within 30 days; and none thereafter. (See University Calendar, page 2.) A degree candidate who withdraws from UNH and subsequently enrolls as a special student within the following year will be billed for tuition and fees on the same basis as degree candidates. Students with outstanding financial obligations to the University must clear their accounts before their registration will be confirmed.

A $10 fee must be paid by all students dropping courses after the second Friday of classes. The $10 fee will not be charged to persons changing to a reduced load or withdrawing; in both of these cases, the regular tuition rebate policy will apply. If a student has received permission to add a course after the third Friday of classes, a $10 fee will be assessed for each course added. A change of section within the same course is accomplished by a "drop" of one section and an "add" of another; however, only one $10 fee is assessed under these circumstances.

Fees

Required fees for 1982–83 included a Memorial Union assessment fee ($50.00) for the use and administration of the student union; a recreation and physical education fee ($30.00) for the use of recreational facilities; a student activity fee ($41.00) for support of the undergraduate newspaper, yearbook, student government, student lawyer, student radio station, and other student organizations; a student services fee ($17.50) to provide partial support for programs provided by the Division of Student Affairs; a health fee ($68.00) to provide general health care through the Hood House infirmary.

There are no waivers or refunds of these fees. The services and facilities are available to all—the extent to which each student uses them cannot be the factor by which assessment is determined.

An optional student season-athletic ticket may be purchased for $25.00. Optional student accident and sickness insurance is available for all degree candidates and full-time nondegree candidates. Participants in intercollegiate athletics are required to purchase the student accident and sickness insurance or demonstrate proof of comparable insurance to the respective athletic department. The 1982–83 cost for student accident and sickness insurance was $77.00 for a full calendar year.

Rebates

Any amount owing to the University will be deducted from any rebate due to a student.

Room and Board

Housing charges average $1,214 per academic year.

Students applying for a room on campus must include a $100 prepayment fee with the housing application. Written notification of cancellation of the room application or assignment received before August 15 will result in forfeiture of the fee. Written notification of cancellation after August 15 and before closing Registration Day will result in a charge of one-fourth of the full semester's room rent. If students fail to occupy assigned rooms by one day after Registration Day, their Room Agreements will be canceled and the students charged for one-half of the full semester's rent. Written notification of cancellation of room received by the Office of Residential Life after Registration Day and within 30 days from Registration will result in the students' being charged for one-half of the full semester's rent. For cancellation of room 30 days or more after Registration, students will be charged for the full semester's rent.

Refunds on meal tickets will be granted only on approved waivers or withdrawal from the University. Cancellation of a meal plan before Registration Day will result in a 100 percent refund; after Registration Day but before the end of the first week of the semester, 75 percent refund; and after the end of the first week but before the end of the fourth week, 50 percent refund. Refunds after the fourth week through the end of the twelfth week will be based on the remaining food cost portion of the meal plan. No refunds will be made after the end of the twelfth week. Generally, rebates will not be allowed for missed meals except in the case of illness.

Deposits

Refundable deposits may be required to cover locker keys or loss or breakage in certain departments. A charge will be made for individual lessons in music, as noted in the description of applied music courses. A charge will be made for riding lessons and SCUBA, as noted in the sections on animal sciences and physical education, and for field trips of the Thompson School, the Institute of Natural and Environmental Resources, and family and consumer studies. For certain courses, there are also lab fees.

Other Expenses

Books and classroom supplies cost approximately $200. These may be purchased at the University Bookstore.

Personal expenses average $500. These will vary with the needs of individual students, and include clothing, laundry, recreation, incidentals, and travel.

Payment

All bills, including those for room and board in University buildings, are due and payable in full on or before Registration Day for each semester.

Parents and students who wish to make periodic payments should consult their local banks or other financial institutions that provide programs for budgeting educational expenses.

Fees and Expenses (1982–83)*	N.H. Residents	Non-Residents
Tuition	$1,750.00	$4,850.00
Room (average)	1,214.00	1,214.00
Board (19 meals/wk.)	1,060.00	1,060.00
Activity fee	41.00	41.00
Recreational/physical education fee	30.00	30.00
Memorial Union fee	50.00	50.00
Student services fee	17.50	17.50
Health fee	68.00	68.00
Books, class supplies	200.00	200.00
Total	$4,430.50	$7,530.50
Individual expenses	500.00	500.00
Athletic admissions ticket (optional)	25.00	25.00
Health insurance (optional)	77.00	77.00

*The University reserves the right to adjust charges for such items as tuition, board, student fees, and room rent. Such changes will be announced as far in advance as feasible.

University Academic Requirements

General Education Requirements

To be graduated from the University of New Hampshire, students must fulfill three types of requirements: University (General Education), degree, and major requirements.

In addition to the particular requirements for specific degrees, all candidates for a bachelor's degree must successfully obtain a passing grade in a minimum of 128 credits in courses numbered 400–799, must maintain a cumulative grade-point average of at least 2.00 for all courses taken at the University in which a grade is given, and must successfully meet, as soon as possible in their University careers, the following General Education Requirements:

Group I

Four courses, each of which must carry at least three credits, from the biological sciences area and from the physical sciences and mathematics area. Students must select at least one course from each of these areas. Pass/fail may not be used for courses taken to meet this requirement.

Biological Sciences

Animal Science 400, 401
Biochemistry 501
Biology 401, 402, 403, 420
Botany and Plant Pathology 411 or 412, 503, 525, 566
Entomology 400 or 402
Forest Resources 634
Hydrology 504
Microbiology 501, 503
Plant Science 421, 535
Soil Science 501 or 502
Zoology 412, 507-508, 542

Physical Sciences and Mathematics

Chemical Engineering 501, 502
Chemistry 401-402, 403-404, 405, 406, 409
Computer Science 410 (two credits each)
Earth Sciences 401, 402, 409, 501
Electrical and Computer Engineering 431, 432
Mathematics 419, 420, 425-426, 636
Mechanical Engineering 561
Physics 401-402, 405, 406, 407-408, 411
Technology 405

Group II

Six courses, each of which must carry at least three credits, from the arts and humanities area and the social sciences area. Students must select at least two courses from each of these areas. Pass/fail may not be used for courses taken to meet this requirement.

Arts and Humanities

The Arts 431, 432, 480, 481, 482, 483, 484, 485, 486, 501, 513, 519, 525, 532, 546, 551, 567, 575, 577, 578, 580, 582, 583, 585, 586, 588, 589, 593, 594, 597
Classics 501, 506, 511, 512, 521, 522
English 501, 505, 512, 513, 514, 515, 516, 518, 519, 520, 521, 522, 523, 525, 533, 585, 586, 595, 657, 685, 690
French 503-504, 519, 620, 621, 622
German 503-504, 525, 656, 693, 694
Greek 503-504
Humanities 401, 501, 502, 503
Italian 503-504, 605, 606
Latin 503-504
Linguistics 505 (same as English 505), 506 (same as Classics 506)
Music 401, 402, 511, 513
Philosophy 401, 412, 416, 417, 421, 424, 430, 435, 475, 496, 520, 530, 550, 570, 571, 572, 573, 577, 600, 630, 635
Religious Studies 501
Russian 503-504, 521, 525
Spanish 503-504, 507-508, 525, 526, 621, 622, 651, 652, 653, 654
Theater and Communication 402, 404, 435, 436, 438, 455, 457, 461, 462, 463, 503, 533, 572, 638, 656
Women's Studies 401 (may also be taken as a social science course)

Social Sciences

Anthropology 411, 412, 512, 614, 616, 618
Community Development 507, 508
Economics 400, 401, 402 (or REco 411 but not both), 515, 518, 615, 630
Family and Consumer Studies 525
Geography 401, 402, 512, 513, 531, 540, 581, 582, 583, 610, 683
History 401, 403, 404, 421, 435, 436, 505, 506, 510, 521, 522, 531, 532, 559, 560, 575, 576, 579, 580, 585, 586, 587, 588, 595, 596
INER 635
Political Science 400, 401, 402, 403, 500, 506, 520, 521, 522, 523, 553
Psychology 401, 461, 511, 521, 531, 551, 553, 571, 581, 721, 770, either Soc 500 or Psyc 552
Recreation and Parks 400
Resource Economics 411 (or Econ 402 but not both), 506, 606
Social Service 522
Sociology 400, 530, 540, 560, 600, 611, 612, 615, 629, either Soc 500 or Psyc 552
Women's Studies 401 (may also be taken as an arts and humanities course)

Group III

Six courses, one of which may be Engl 401 (required for graduation), and each of which must carry at least three credits, from all courses offered by the University, including those in Groups I and II.

Courses that may be used to meet Group I and Group II requirements are approved by the Calendar and Curriculum Committee of the University Academic Senate.

The University, college, or department may prescribe up to eight of the sixteen courses used to satisfy the General Education Requirements. At least eight courses are to be freely elected by the student. Courses taken to satisfy General Education

Requirements may not be in the student's declared major. Thompson School courses taken by a regularly matriculated student will not satisfy General Education Requirements except in specified cases in certain approved programs.

Engl 401 (freshman reading and composition) is required of all undergraduates. It may not be used to satisfy the arts and humanities area General Education Requirement, nor may it be taken pass/fail.

Grades and Grading Symbols

Instructors assign grades as listed below; grade points per semester hour are indicated in parentheses. For all undergraduate courses, grading standards established by the Academic Senate are that a C indicates competent, acceptable performance and learning; B indicates superior performance and learning; and A indicates excellent performance and learning. These standards apply to all undergraduate courses, instructors, departments, subjects, and colleges. The University reserves the right to modify grading and honors practices.

A (4.00)	Excellent
A− (3.67)	Intermediate grade
B+ (3.33)	Intermediate grade
B (3.00)	Superior
B− (2.67)	Intermediate grade
C+ (2.33)	Intermediate grade
C (2.00)	Satisfactory, competent
C− (1.67)	Intermediate grade
D+ (1.33)	Intermediate grade
D (1.00)	Marginal grade
D− (0.67)	Intermediate grade
F (0.00)	Failure: academic performance so deficient in quality as to be unacceptable for credit
WF (0.00)	Withdrawal while failing; the 0 credit is computed in student's grade-point average
AF (0.00)	Administrative F (usually indicates student stopped attending without dropping the course); is included in grade-point average
Cr	Credit: given in specific courses having no letter grades, designated credit/fail
P	Passing grade in a course taken under the student pass/fail grading alternative
W, W—	Withdrawal grade—assigned if withdrawal is later than midsemester; is not included in grade-point average
AU	Audit—no credit earned
IC	Grade report notation for student's incomplete coursework
IA	Indicates "incomplete" in a thesis or continuing course of more than one semester; the grade earned will replace "IA" assigned in previous semesters
IX	Grade not reported by instructor

Students earning a semester or cumulative grade-point average less than 2.00 are placed on "academic warning."

Pass/Fail While earning a bachelor's degree, students may choose the pass/fail grading alternative: a) for a maximum of 16 credits during their matriculation; b) for a maximum of 4 credits per semester; c) in courses *other than* major requirements, optional minor requirements, Engl 401, and Group I and II requirements.

For B.A., B.F.A., and B.M. candidates, the pass/fail alternative is not permitted in courses that are used to meet the foreign language requirement. No Whittemore School course may be taken on a pass/fail basis by a student majoring in administration, economics, or hotel administration.

The minimum passing grade for credit is a D− (0.67); any grade below this minimum is a fail. All grades will be recorded on the grade roster as A, B, C, D, F, or intermediate grades. The pass/fail marks will be placed on students' transcripts and grade reports by the Registrar's Office. The course will not be included in the grade-point calculation, but the pass or fail will be recorded, and in the case of a pass, the course credits will be counted toward degree requirements.

Students may not use the pass/fail alternative to repeat a course. Associate in Arts students, see page 85.

Honors An undergraduate degree student, after completion of at least 12 graded semester hours in University of New Hampshire courses, will be designated as an honor student for a given semester if the student has: a) completed at least 12 graded semester hours for that semester and earned at least a 3.20 semester grade-point average; or b) earned at least a 3.20 cumulative grade-point average and at least a 3.20 semester grade-point average regardless of the number of graded credits that semester. These categories will be used: 3.20 to 3.49 (honors), 3.50 to 3.69 (high honors), and 3.70 to 4.00 (highest honors).

Bachelor's degree candidates who have earned honors for their entire work at the University will be graduated with honors based on the final cumulative grade-point average, provided that a minimum of 64 graded semester hours have been completed in University of New Hampshire courses. The Latin equivalent of the honors classification will appear on the student's academic record and diploma. The student's honors classification will be noted in the commencement program.

Degree Requirements

Grading and honors policies as stated in this catalog apply to all undergraduate students.

Other requirements in this catalog apply to students who enter the University between July 1, 1983, and June 30, 1984. (Students who entered the University at an earlier time but who wish to change to the requirements of this catalog must apply to the appropriate office for the change.) Students will be held responsible for all work required for graduation and for the scheduling of all necessary courses.

Modifications tend to occur in major programs during the four-year period of students' undergraduate careers. Students are expected to conform to these changes insofar as they do not represent substantive alterations in their course of study.

Bachelor of Arts

1. At least 128 credits with a minimum cumulative grade-point average of 2.00 in all University of New Hampshire courses.

2. Completion of the University General Education Requirements. This is intended to insure that all students receiving the Bachelor of Arts degree acquire reasonable exposure to and learning in the arts and humanities, social sciences, and natural sciences.

3. Proficiency in a foreign language at the level achieved by satisfactory work in a one-year, college-level course. This requirement may be fulfilled by achieving a score of 500 or better on a College Board foreign language achievement test, or by completing a full-year elementary course in any foreign language, or by completing a semester of a course in a foreign language beyond the elementary year. This requirement must be satisfied by the end of the sophomore year.

4. Satisfaction of major requirements by completing at least 32 credits of major coursework with grades of C− or better and a grade-point average of 2.00 or better. A major may require a senior paper or project and/or a comprehensive examination.

Bachelor of Fine Arts, Bachelor of Music, Bachelor of Science

Requirements for the B.F.A. degree are on page 35; for the B.M. degree, on page 36; and for the B.S. degree, on pages 37, 39, and 50.

Associate in Arts

1. Completion of at least 64 credit hours with a minimum grade-point average of 2.00 based on a 4.00 scale.

2. Completion of General Education Requirements as follows:

Group I Two courses, each of which must carry at least three credits, from either of the following areas:

a. biological sciences
b. physical sciences and mathematics

Group II Three courses, each of which must carry at least three credits, from the following areas:

c. arts and humanities
d. social sciences

Students are required to elect at least one course each in both c and d.

Group III Three courses, one of which must be freshman English and each of which must carry at least three credits, from all courses offered by the University, including those in Groups I and II.

Courses that may be used to meet Group I and Group II requirements are listed on page 14.

The Division of Continuing Education may prescribe up to four of the eight courses used to satisfy the General Education Requirements. A minimum of four courses is to be freely elected by the student. Courses taken to satisfy General Education Requirements may not be in the student's declared career option.

A University freshman English course in reading and composition (English 401) is required of all undergraduates. The freshman English course may not be used to satisfy the arts and humanities requirement in general education.

3. The remaining courses or credits may be earned in a career option and/or in elective general education courses.

4. The last 16 hours of credit must be for University of New Hampshire courses completed through the Division of Continuing Education at UNH following admission and matriculation, unless permission is granted to transfer part of this work from another institution.

Dual Degrees

The opportunity to pursue simultaneously two undergraduate degrees enhances and broadens the education of certain students. The program is only for those students who can adequately handle the requirements for two different degrees and who can reasonably allocate the additional time and effort needed for the program. Except for specific five-year degree programs (page 20), a student may not pursue two different degree levels simultaneously.

Requirements

1. Students desiring dual degrees must petition the college dean or deans involved for permission.

2. Students planning to take one degree in a highly prescribed curriculum should register as freshmen in the appropriate school or college for that curriculum.

3. It is expected that candidates for two degrees will complete 32 credits beyond those required for the first degree.

4. The two degrees, as awarded by the University of New Hampshire, must be different (e.g., B.A. and B.S., or B.S. and B.S. in Chemistry). Transfer students already holding a baccalaureate degree from another accredited institution may pursue an additional baccalaureate degree at the University of New Hampshire provided they fulfill the previously listed requirements. The degree received at the first institution will be accepted by UNH as awarded by that institution.

Supervision As soon as a student is accepted as a candidate for two degrees, the appropriate dean(s) will appoint supervisors for each of the proposed majors. The supervisors and the student will work out a basic course plan for the two degrees and inform the appropriate dual degree dean(s) of the plan. The supervisors will maintain joint control over the student's academic program. The college offices and the supervisors will receive copies of grade reports and other records for students pursuing two degrees.

Minimum Graduation Average

A cumulative grade-point average of 2.00 in University of New Hampshire courses is the minimum acceptable level for undergraduate work in the University and for graduation. The Academic Standards and Advising Committee examines the rec-

ords of students periodically and may place academically deficient or potentially deficient students on warning, or may exclude, suspend, or dismiss those who are academically deficient.

Quota of Semester Credits

Students registering for more than 20 credits must receive the approval of the college dean.

Undergraduates are assigned class standing on the basis of semester credit hours of academic work completed with a passing grade, as follows: to be a sophomore—26 credit hours; to be a junior—58 credit hours; to be a senior—90 credit hours.

Residence

"Residence" means being enrolled in University of New Hampshire courses after admission to and matriculation in a degree program. Students who are candidates for a bachelor's degree must attain the last one-quarter of total credits for the degree in residence unless granted permission by the Academic Standards and Advising Committee to transfer part of this work from other accredited institutions.

Withdrawal from the University

Students who leave the University are expected to file formal withdrawal notification with the registrar.

Note: Although the University will try to provide sufficient facilities so that students may pursue any major or curriculum for which they meet the requirements, such a privilege cannot be guaranteed, since rapidly increasing enrollment sometimes results in the overcrowding of required specialized courses. On occasion, students may remain in a crowded curriculum if they are willing to take certain courses during the summer session.

Majors and Minors

Majors are described under their various schools and colleges, and a few that are intercollege are described in the section on "Special University Programs."

Student-Designed Majors

See page 80 for requirements for a student-designed major.

Second Majors

Bachelor's degree students may choose to fulfill the requirements of two dissimilar major programs, provided they obtain the approval of their principal adviser and the dean(s) of the college(s) in which the programs are offered, and comply as follows:

1. If the two majors are offered in different schools or colleges within the University, the admissions requirements of each must be satisfied.

2. If the two majors have two distinct degrees, e.g., B.A., B.S., or some other designated degree, students must choose which of the two degrees is to be awarded and fulfill all requirements for that degree.

3. No more than eight credits used to satisfy requirements for one major may be used as requirements for the other major.

Minors

Students may earn a minor in any undergraduate discipline designated by the University. A list of minors is available from the advising coordinator in each college or school. Students must consult with the major adviser and the minor supervisor. A minor consists of 20 semester hours with C− or better and a 2.00 grade-point average in courses that the minor department approves. Courses taken on the pass/fail basis may not be used for a minor. No more than eight credits used to satisfy major requirements may be used for the minor. Students should declare an intent to earn a minor as early as possible and no later than the end of the junior year. During the final term, an application should be made to the dean to have the minor shown on the academic record.

Abbreviations

Department Abbreviations

The following abbreviations are used to identify undergraduate and graduate courses offered at the University. An asterisk preceding the letters identifies those disciplines in which graduate programs are offered.

College of Liberal Arts

Anth	Anthropology
Arts	The Arts
* Biol	Biology
Clas	Classics
* Educ	Education
* Engl	English
Fren	French
Geog	Geography
Germ	German
Grek	Greek
* Hist	History
Huma	Humanities
Ital	Italian
Latn	Latin
Ling	Linguistics
* Micr	Microbiology
* Musi	Music
* MuEd	Music Education
Phil	Philosophy
* Polt	Political Science
* Psyc	Psychology
R S	Religious Studies
Russ	Russian
ScSc	Social Science
S S	Social Service
* Soc	Sociology
* Span	Spanish
ThCo	Theater and Communication
W S	Women's Studies
* Zool	Zoology

College of Life Sciences and Agriculture

* AnSc	Animal Sciences
* Bchm	Biochemistry
* Bot	Botany and Plant Pathology
C D	Community Development
* Ento	Entomology
* FCS	Family and Consumer Studies
* FoRs	Forest Resources (INER)
* Hydr	Hydrology (INER)
* INER	Institute of Natural and Environmental Resources
Nutr†	Nutritional Sciences
* OcEd	Occupational Education
* PlSc	Plant Science
* REco	Resource Economics (INER)
* Soil	Soil Science (INER)

College of Engineering and Physical Sciences

* ChE	Chemical Engineering
* Chem	Chemistry
* CiE	Civil Engineering
* C S	Computer Science
* ESci	Earth Sciences
* E E	Electrical and Computer Engineering
E T	Engineering Technology
* Math	Mathematics
* M E	Mechanical Engineering
* Phys	Physics
* Engr	Engineering Ph.D.
Tech	Technology (nondepartmental)

School of Health Studies

* Comm	Communication Disorders
HAP	Health Administration and Planning
MedT	Medical Technology
* Nurs	Nursing
O T	Occupational Therapy
* PhEd	Physical Education
RecP	Recreation and Parks
SHS	School of Health Studies

Whittemore School of Business and Economics

* Admn	Administration
* Econ	Economics
Hotl	Hotel Administration
Secr	Secretarial Studies

Separate Departments and Programs

Aero	Aerospace Studies
DCE	Division of Continuing Education (all courses)
* Gen	Genetics Program
Inco	Intercollege
Milt	Military Science
TSAS	Thompson School of Applied Science

† This major is pending final Trustee approval.

Degrees and Major Programs of Study

Colleges

College of Liberal Arts

The Teacher Education division of the College of Liberal Arts coordinates the five-year graduate/undergraduate teacher education program. See page 22.

Bachelor of Arts
Anthropology
The Arts
  Art History
  Art Studio
Classics
Communication
English
English Teaching
French
Geography
German
Greek
History
Humanities
Latin
Linguistics
Microbiology
Music
  Music History
  Music Theory
  Performance Study
  Preteaching
Philosophy
Political Science
Psychology
Russian
Social Work
Sociology
Spanish
Theater
Zoology

Bachelor of Fine Arts
Fine Arts

Bachelor of Music
Music
  Music Education
  Organ
  Piano
  Strings, Woodwind, Brass, or Percussion
  Theory
  Voice

Bachelor of Science
Biology

College of Life Sciences and Agriculture

Bachelor of Arts
Botany and Plant Pathology
Entomology

Bachelor of Science
Animal Sciences
  Animal Industry
  Preveterinary Medicine
  Science
Biochemistry
Biology
Botany and Plant Pathology
Entomology
Family and Consumer Studies
  Child-Family Studies
  Consumer Studies
General Studies
Nutritional Sciences§
Occupational Education
Plant Science
  General
  Science
(within the Institute of Natural and Environmental Resources)
Community Development
Environmental Conservation
Hydrology
Resource Economics
Soil Science
Wildlife Management

Bachelor of Science in Forestry
(within the Institute of Natural and Environmental Resources)
Forest Resources
  Forest Management
  Forest Science

College of Engineering and Physical Sciences

Bachelor of Arts
Chemistry
Chemistry and Physics Teaching
Earth Science Teaching
Geology
Mathematics
Physics
Science‡

Bachelor of Science
Chemical Engineering*
  Energy
  Environmental Engineering
Chemistry*
Civil Engineering*
  Constructed Systems
  Environmental Engineering
Computer Science*
Electrical Engineering*
  Computer Engineering
  Electrical Engineering Systems
  Student-Designed Option
Geology*
Mathematics*
Mathematics Education*
  Elementary
  Secondary

Mathematics (Interdisciplinary)
- Mathematics—Chemistry
- Mathematics—Computer Science
- Mathematics—Economics
- Mathematics—Electrical Science
- Mathematics—Fluid Dynamics
- Mathematics—Mechanics
- Mathematics—Physics
- Mathematics—Statistics
- Mathematics—Thermodynamics

Mechanical Engineering*
- Energy

Physics*

Bachelor of Engineering Technology
Electrical Engineering Technology
Mechanical Engineering Technology

Schools

Whittemore School of Business and Economics

Bachelor of Arts
Economics

Bachelor of Science
Administration
Hotel Administration

School of Health Studies

Bachelor of Science
Communication Disorders
Health Administration and Planning
Medical Technology
Nursing
Occupational Therapy
Physical Education
- Athletic Training
- Exercise Specialist in Health Maintenance
- Pre–Physical Therapy
- Sports Communication
- Teacher Certification

Recreation and Parks
- Recreation Administration
- Recreation Programming
- Recreation Resources Management

Thompson School of Applied Science, of the College of Life Sciences and Agriculture

Associate in Applied Science
Applied Animal Science
Applied Business Management
Civil Technology
Food Services Management
Forest Technology
Horticultural Technology

Other Programs

Division of Continuing Education

Associate in Arts
Career Concentrations
- Accounting
- Computer Information Studies
- Criminal Justice
- Library and Information Services
- Management
- Merchandising
- Real Estate

Five-Year Degree Programs

Bachelor of Arts and Master of Business Administration
Bachelor of Science and Master of Business Administration
Bachelor of Arts and Master of Education
Bachelor of Science and Master of Education

Interdisciplinary Minors†

Biomedical Systems and Instrumentation
Environmental Engineering
History and Philosophy of Science
International and Foreign Area Studies
Materials Science
Ocean Engineering
Oceanography
Religious Studies
Women's Studies

Advisory Committees

Genetics
Interdepartmental Biology
Prelaw
Premedical-Predental

The Graduate School

Master of Arts
Master of Science
Master of Arts in Teaching
Master of Business Administration
Master of Education
Master of Occupational Education
Master of Public Administration
Master of Science for Teachers
Certificate of Advanced Graduate Study
Doctor of Philosophy

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* Designated degree (The name of the specialization is included on the diploma; e.g., B.S. in Chemistry.)
† For other interdisciplinary programs, see pages 79–83.
‡ Science majors must declare an area of concentration; e.g., chemistry, earth sciences, mathematics, physics.
§ This major is pending final Trustee approval.

College of Liberal Arts

Stuart Palmer, Dean
Melville Nielson. Associate Dean
James A. Smith, Associate Dean

Divisions and Departments

Biological Science Division
Microbiology Department
Zoology Department

Humanities Division
Ancient and Modern Languages and Literatures Department
The Arts Department
English Department
French Department
Music Department
Philosophy Department
Theater and Communication Department

Social Science Division
Geography Department
History Department
Political Science Department
Psychology Department
Social Service Department
Sociology and Anthropology Department

Teacher Education Division
Education Department

Programs of Study

Bachelor of Arts
Anthropology
The Arts
  Art Studio
  Art History
Classics
Communication
English
English Teaching
French
Geography
German
Greek
History
Humanities
Latin
Linguistics
Microbiology
Music
  Music History
  Performance Study
  Music Theory
  Preteaching
Philosophy
Political Science
Psychology
Russian
Social Work
Sociology
Spanish
Theater
Zoology

Bachelor of Science
Biology

Bachelor of Fine Arts

Bachelor of Music
  Piano
  Organ
  Voice
  Strings, Woodwind, Brass, or Percussion
  Theory
  Music Education

Purpose and Programs

It is the purpose of the College of Liberal Arts, as a center of learning and scholarship, to help students achieve an understanding of the heritage of civilization and to educate them in the tradition of the past and realities of the present so that they may recognize and act upon their obligations to the future.

The college seeks to meet the educational needs of each student through the development of interests and skills which, combined with the individual's potential, makes possible the living of a richer, more useful life.

Degrees

The College of Liberal Arts offers four degrees: Bachelor of Arts, Bachelor of Science, Bachelor of Fine Arts, and Bachelor of Music.

Bachelor of Arts These programs primarily provide a broad liberal education along with a major in one of the fields listed on the previous page. Requirements for the Bachelor of Arts degree and information regarding these majors are presented on page 16.

Bachelor of Science This curriculum consists of an interdepartmental program in biology which permits students considerable specialization while providing them with a broad cultural education. Requirements for the Bachelor of Science degree and information regarding the biology curriculum are presented on page 37.

Bachelor of Fine Arts This curriculum provides training for students who plan to enter a professional graduate school. Requirements for the Bachelor of Fine Arts degree are outlined on page 35.

Bachelor of Music This curriculum provides professional training in performance, in musical theory, and in music education, and allows students to develop their talent to a standard equivalent to the one achieved at conservatories of music. Requirements for the Bachelor of Music degree and information regarding the curriculum are presented on pages 36–37.

Five-Year Program: B.A.-M.B.A. The College of Liberal Arts and the Whittemore School of Business and Economics offer a combined five-year program leading to a B.A. degree in French, history, philosophy, or psychology and an M.B.A. degree. Information about the program can be obtained from the department or from the undergraduate counselor in the Whittemore School.

Combined Programs of Study

In addition to pursuing a single major, students may combine programs of study as follows:
Minors: See page 17 for requirements. See also Interdisciplinary Minors, pages 23 and 50.
Second Majors: See page 17 for requirements.
Dual-Degree Programs: See page 16 for requirements.
Student-Designed Majors: See page 80 for requirements.
Other combined programs and interdisciplinary opportunities are described in Special University Programs, pages 79–83.

Preparing for Teaching

The teacher education programs at the University are accredited by the New Hampshire State Department of Education and by the National Council for the Accreditation of Teacher Education. UNH participates in the Interstate Certification Compact; consequently, completion of the approved teacher preparation program of the University qualifies students for certification as teachers in most states.

UNH offers approved programs in agriculture, art, biology, chemistry, earth sciences, elementary education, English, French, German, family and consumer studies, Latin, mathematics, music, occupational education, physical education, physics, pre-school education, social science, Spanish, speech therapy, and speech and drama.

Five-Year, Undergraduate-Graduate Program

The major avenue for becoming certified to teach at the elementary, middle, or high school level is an integrated undergraduate-graduate program culminating in a fifth-year, year-long internship. Before the intership, students earn a bachelor's degree outside the field of education. The internship offers 6–12 graduate credits, which students usually couple with other graduate work leading to a master's degree. A number of UNH master's degree programs may be elected, including two offered by the Department of Education that are specifically designed for preservice teaching. (See Graduate Catalog for description.)

Step 1. Register for Educ 500 (preferably in sophomore year).

Educ 500, Exploring Teaching, provides an early experience in the schools as a teacher aide and teaching assistant. Students may select this four-credit course at any time; however, most should choose it before completing their sophomore year. Working side by side with experienced teachers, students explore various teaching roles so that they may make realistic decisions about teaching as a career.

Step 2. Apply to the Department of Education for admission to the second phase of the teacher education program and for a co-adviser from that department, who will provide assistance in designing the most appropriate plan of studies. The plan must include a minimum of four credits in each of four areas of study: Educ 700, Educational Structure and Change; Educ 701, Human Learning and Development; Educ 703, Alternative Teaching Models; and Educ 705, Alternative Perspectives on the Nature of Education. Since there is no undergraduate major in education, students must complete a major in another department for a baccalaureate degree.

A number of variable-credit modules are avail-

able to students in each of the required four course areas, including experiences and workshops in local schools. Certain courses in other departments may be substituted for these requirements. Working closely with advisers, students may develop highly individualized programs, choosing from many alternatives. Since credit in these four areas of study may be taken at either the undergraduate or graduate level, students have greater flexibility for fulfilling the requirements of their college and major departments.

Additional requirements for elementary school teaching include one course in elementary school reading (Educ 706, Introduction to Reading Instruction in the Elementary Schools) and two courses in mathematics appropriate for elementary school teaching (recommended—Math 621, Number Systems for Elementary School Teachers; Math 622, Geometry for Elementary School Teachers; Math 623, Topics for Elementary School Teachers; 703, Mathematics Education, K-6).

Step 3. Apply for admission to the fifth-year internship and master's degree program.

The final phase of the teacher education program consists of a year-long internship (Educ 800, 801). **Students must apply for the fifth-year internship and master's degree program by September 15 of their senior year** so that they will have enough time to explore a variety of career and/or graduate study options and conclude their program plans before second semester of that year. Opportunities exist for admitted graduate students to take courses toward their master's degree in the second semester of their senior year.

Before the internship, students will have completed a B.A. or B.S. program with a major outside the field of education. They will have, therefore, a broader general education and greater depth in their area of specialization, as well as opportunities for jobs outside of education. For secondary school certification, students must have completed an approved major program, or its equivalent, in the subject they intend to teach. Candidates for elementary school certification may choose from any of the majors offered at the University.

If accepted into the internship and master's degree program, students have several options from which to choose, including selection of additional courses for further specialization, and selection of workshops and courses offered for credit in intern-site schools. During the internship, students have an opportunity to work with resident supervisors and other interns in various team-teaching arrangements.

Financial Aid A limited number of paid internships are available. Students are hired by participating school districts. Other financial assistance is possible through the Office of Financial Aid.

Criteria for Admission to Fifth Year To be eligible for an internship, students must satisfy the following criteria: 1) favorable rating from school personnel who have worked with them in Exploring Teaching and in any other clinical experience; 2) favorable rating from UNH staff supervising Exploring Teaching and other clinical experience; 3) favorable recommendation from instructors of professional coursework; 4) favorable recommendation from their major program, including approval of the major program as appropriate for secondary school teaching; 5) admission to the UNH Graduate School, which requires a minimum of 2.50 cumulative grade-point average, Graduate Record Examination scores, and appropriate letters of recommendation; 6) available space in the program.

For further information, contact Michael D. Andrew, coordinator of teacher education.

Undergraduate Certification Option

Because of the specialized orientation of majors in occupational education, mathematics, physical education, preschool education, and music education, an undergraduate option for teacher certification in these areas may be elected. This option requires the same education components listed previously, with the election of one semester of student teaching (Educ 694) instead of the year-long internship. Successful completion of Educ 500 and positive recommendation from school-site staff are required for continuation in the program. Final screening takes place before the student-teaching semester. Application for acceptance into student teaching must be filed by February 15 of the junior year.

Academic standards for admission to the option include a minimum 2.50 grade-point average in the major and a minimum 2.20 cumulative grade-point average at the time of application for student teaching.

These programs have limited capacity, and admission to the University or satisfaction of minimum academic standards as stated previously does not guarantee admission to the teacher education programs.

For further information, contact Michael D. Andrew, coordinator of teacher education.

Interdisciplinary Minors

History and Philosophy of Science Minor

This interdisciplinary minor is designed for students who wish to study the historical and philosophical foundations of the natural and social sciences. It may be combined with any undergraduate major field. General introductions to any of the disciplines are not among the goals; rather, the objective is to acquire skills in historical thinking and critical analysis relevant to the discovery, growth, and application of scientific knowledge.

Further information is available from the Advising Center, Murkland Hall, including annual listings of the courses and instructors. Any instructor teaching one of the courses may serve as a contact person. A minor consists of any five of the courses listed, with no more than three from any single department.

Hist 521. History of Science (to the Renaissance)
Hist 522. History of Science (post-Renaissance)
Hist 622. History of American Thought

Hist 651. European Intellectual History
Hist 652. European Intellectual History
Hist 789. Seminar in the History of Science
Phil 424. Science, Technology, and Society
Phil 435. The Human Animal
Phil 630. Philosophy of the Natural Sciences
Phil 683. Technology: Philosophical and Ethical Issues
Phil 725. Philosophy of the Social Sciences
Phil 780. Special Topics in Philosophy*
Psyc 571. The Great Psychologists
Psyc 591. Special Topics in Psychology*
Psyc 770. History of Psychology
Psyc 771. Survey of Twentieth-Century Psychology

*with approval

International and Foreign Area Studies Minor

This minor, designed to meet the needs of undergraduates who wish to pursue their studies with an international or an area focus, provides interdisciplinary support for students' major interests. Students interested in this minor should consult the minor requirements in their respective colleges and schools. The program is administered by an international studies minor supervisor.

A minor in international and foreign area studies consists of 20 credits (normally five courses) and knowledge of a foreign language. Courses that may be applied toward this minor are listed in the *Bulletin for International and Foreign Area Studies Minors*, which is available from the international studies minor supervisor. For approval of the minor, students must meet the following requirements:

1. Complete a minimum of one and a maximum of two courses from a list of general international courses.

2. Select a foreign area from among the six offered (Asia, West Europe, Soviet and East Europe, Africa and the Middle East, Canada, Latin America) and complete a minimum of three and a maximum of four courses from among those listed for that area.

3. Demonstrate knowledge of a foreign language relevant to the selected geographic area. This requirement will ordinarily be met by one of the following:

a. Successful completion of the following courses in a language relevant to the area: Fren 504 or 514; Germ 504; Ital 504; Portuguese (see "c"); Russ 504; or Span 504.

b. Successful completion of courses taught in the relevant language above the level of the courses listed in "a."

c. Certification by the language department concerned. Students who select an area in which no relevant language is currently being offered or students with a knowledge of a foreign language not offered in University language programs should contact the international studies minor supervisor.

4. No more than two courses from any one department may be applied toward the minor.

5. With the approval of the international studies minor supervisor, courses taken during the junior year abroad (Salzburg, Austria; Dijon, France; or Valencia, Spain) can be counted toward the minor.

For further information, students should contact the Dean's Office, College of Liberal Arts.

Religious Studies Minor

The religious studies minor offers a scholarly investigation and analysis of various religious phenomena in a multi-disciplinary and cross-cultural manner. Included are such approaches as comparative religion, history of religion, philosophy of religion, psychology of religion, sociology of religion, and religious literature. It entails no sectarian or theological bias. It uses a number of scholarly methods and tools to investigate various religious traditions, as well as such cross-cultural aspects of religion as prayer, belief, mythology, male and female images and roles, ritual, scripture, sectarianism, religious movements, religion and society, and religion and politics.

Students minoring in religious studies must take a survey of world religions (presently provided by Philosophy 416, Philosophical Survey of World Religions); Religious Studies 501, (Contemporary Approaches to the Study of Religion); Religious Studies 699, Senior Seminar; and the equivalent to two other 4-credit courses—for a total of at least 5 courses, one of which must be at the 600 or 700 level. The two "other" courses may include Religious Studies 599 (Special Topics) and Religious Studies 695, 696 (Independent Studies), or any course accepted for the minor by the Religious Studies Executive Board or approved by petition to the board. Currently, such acceptable courses include the following:

Engl 518 The Bible as Literature
Hist 575 The Ancient Near East
Hist 639, 640 Three Medieval Civilizations
Hist 642 The Age of Reformation
Hist 661, 662 England in the Tudor and Stuart Periods
Hist 663 Russia: Origins to Modernization
Hist 683 Religion in World History
Phil 417 Philosophical Reflections on Religion
Phil 520 Introduction to Eastern Philosophy
Phil 571 Medieval Philosophy
Phil 710 Philosphy of Religion
Anth 616 Anthropology of Religion
Anth 732 Area Studies in Archaeology: Near East
Soc 797 Special Topics: Q—Religious Topics.

Students wishing to minor in religious studies or who wish more information should consult with the coordinator, John Voll, 443 Horton Social Science Center.

Women's Studies Minor

The women's studies minor provides students with an interdisciplinary introduction to the status of women in various cultures and historical eras, as well as to the contribution of women to various fields of endeavor. In addition, women's studies courses offer students a critical perspective on such

basic questions of the social order as assumption about gender roles and gender identity.

For the women's studies minor, students must complete 20 credits of women's studies courses. These must include W S 401, Introduction to Women's Studies, and W S 798, Colloquium in Women's Studies, normally taken at the beginning and end of the course sequence, respectively. In between, students should select other women's studies courses or courses from departmental offerings that have been designated women's studies courses or that have the approval of the women's studies coordinator.

Other women's studies courses are W S 595, Special Topics in Women's Studies, and W S 795, Independent Study.

Departmental offerings include the following regularly repeated courses:

Admn 780. Women in Management
Anth 625. Female, Male, and Society
Educ 7011. Sex Role, Learning, and School Achievement
Engl 585. Introduction to Women in Literature
Engl 586. Introduction to Women Writers
Engl 685. Women's Literary Traditions
Engl 785. Major Women Writers
ThCo 567. Images of Women in Media
S S 701. Women and Aging

Students may complete the minor requirements by selecting from other courses that are offered as special topics by the departments. In the past, such offerings have included the following: Arts 695, Women Artists; Econ 658, Women and Work; Econ 798, Theories of Poverty and Discrimination; Fren 621, Women and Power in Modern France; Hist 596, Women, Family, and Power; and others.

Students who wish to minor in women's studies should consult with the coordinator, Cathryn Adamsky, 307A Dimond Library, 862-2194.

Bachelor of Arts Programs

The Bachelor of Arts program provides a broad liberal education with a concentration involving a minimum of 32 credits in a major field.

Bachelor of Arts Degree Requirements See page 16 for requirements.

Majors in the Bachelor of Arts Program in the College of Liberal Arts A department may specify certain (but not more than 13) required courses. Students must declare a major before the beginning of the junior year.

The objectives, opportunities, and department requirements of the majors in the Bachelor of Arts program are described in the paragraphs that follow.

Anthropology

(For descriptions of courses, see page 186.)

The anthropology major, offered by the anthropology section of the Department of Sociology and Anthropology, provides an introduction to the various branches of anthropology and an appreciation of its place among other academic disciplines. At the same time, the major is designed to encourage intensive study of particular topics within the field, according to the interests and talents of students. It is intended to provide both a broad basis for the education of general students and to offer sufficient background for those who may wish to pursue a career in anthropology at the graduate level.

Majors must complete a minimum of 32 credits with grades of C− (1.67) or higher and a grade-point average of 2.00 or better, distributed as follows: Anth 411, 412, either 516 or 518, one topical course, one ethnographic-area course, and any other three courses in anthropology or related disciplines approved by the supervisor.

Students wishing to major in anthropology should consult with the chairperson of the Department Committee for Undergraduate Studies in Anthropology.

Departmental Honors Honors in anthropology will be awarded to those students who achieve, in addition to the regular requirements of the major, at least a 3.67 grade-point average in courses counted toward the major and satisfactorily complete a four-credit senior thesis under the guidance of a faculty member. A 3.50 overall average is also required. Students wishing to work for honors should inform the undergraduate committee of their intent during the second semester of their junior year, appending their academic record and a statement of the area in which they intend to write a thesis.

The Arts

(For descriptions of courses, see page 103.)

The courses offered by the Department of the Arts provide an opportunity, within the liberal arts framework, for serious art students to acquire a thorough knowledge of the basic means of visual expression, to acquaint themselves with the history of art, or to prepare themselves for a career in art teaching. In addition, these courses are designed to offer foundation experience for students who are interested in art but are majoring in other departments in the University. The Department of the Arts offers programs leading to a Bachelor of Fine Arts degree (see page 35) and a Bachelor of Arts degree. Certification for art teaching in the public schools is also offered in cooperation with the Department of Education (see Preparing for Teaching, page 22).

The arts major leading to a Bachelor of Arts degree is offered with two options: studio and art history.

Candidates applying for the arts major, art studio option, or the Bachelor of Fine Arts program are required to submit a portfolio. There is no portfolio requirement for those entering the art history option of the arts major. The University reserves the right to retain selections from a student's work for a period of not more than two years.

Art Studio Option Students selecting the art studio option must complete a minimum of 11 courses (44 credits), of which the following are required: Arts 432 (Drawing I); one course from the following: Arts 501 (Ceramics I), Arts 513 (Jewelry and Metalsmithing I), Arts 525 (Woodworking), or Arts 567 (Sculpture I); two 400-level art history courses; two 500-level art history courses; one elected art history course; three elected studio courses; and one 600-level studio course. The foundation courses (400-level courses) should be completed during the first year.

While these courses represent the minimum departmental requirements for the studio option, students may wish to plan a program involving greater depth in one or several of the studio areas.

Art History Option Students selecting the art history option must complete a minimum of 10 courses (40 credits), of which the following are required: Arts 432, (Drawing I); Arts 431, (Visual Studies); two additional 400-level art history courses; Arts 696, (Methods of Art History); and five additional courses in art history above the 400-level, of which at least two must be in the Ancient and Medieval areas and at least two must be in the Renaissance and Modern areas. Art history majors will receive preferential placement only in the following studio course: Arts 432. Students majoring in art history are strongly advised to take Engl 501, Introduction to Prose Writing, and two foreign languages, one of which should be German.

Art Education Curriculum The program in art education is organized into a five-year, teacher-education sequence.

This curriculum is designed to prepare teachers of art in the public schools. Completion of the B.A. or B.F.A. degree before a fifth-year internship is necessary for teacher certification. The satisfactory completion of the B.A. or B.F.A. curriculum and the fifth-year internship will satisfy the initial certification requirements for teachers of art in the public schools of New Hampshire and in most other states.

Minor in Architectural Studies The minor in architectural studies provides students with an interdisciplinary introduction to the history, theory, and methods of architecture and its symbolism. The program allows students who are interested in this field to receive programmatic recognition for their work. It is designed to assist those who a) are contemplating enrollment at a school of architecture; b) become particularly interested in architectural history; c) want to supplement their technical majors (e.g., civil engineering) with strong academic minors; or d) plan to pursue careers in preservation, education, community service, and public relations.

The minor in architectural studies consists of 20 credits (ordinarily five courses) distributed in the following way:

Two courses in architectural history chosen from
- Arts 485, Studies in Architectural History
- Arts 594, 17th- and 18th-Century American Architecture
- Arts 595, Early Modern Architecture
- Arts 596, Contemporary Architecture
- Arts 698, Seminar in Architectural History

The course in architectural graphics and design
- Arts 455, Introduction to Architecture

A beginning course in drawing
- Arts 432, Drawing I

An elective chosen in consultation with the program coordinator of the architectural studies minor (an additional course in architectural history, a studio course, or some other appropriate elective)

Admission to the minor will be authorized by the program coordinator. Interested students should consult with the coordinator in advance of selecting the minor.

Classics

(For descriptions of courses, see page 96.)

The classics major is offered by the classics section of the Department of Ancient and Modern Languages and Literatures. The minimum requirements for a major in classics are: 40 credits offered by the classics section, excluding Latin 401-402. Twenty-four of these must be in courses in Greek and Latin. Students will be encouraged to take courses in related fields such as ancient history, classical art, modern languages, and English, and to take part in overseas study programs in Greece and Italy.

The supervisor for majors is John C. Rouman.

Departmental Honors The Honors Program in Classics is designed primarily and specifically for

students of superior ability, demonstrated achievement, and high interest in the study of both Greek and Latin. Students may apply for admission to the program during their junior year. Applicants must have completed at least: Latin 504 and Greek 504, either Latin 631 or Greek 631, one 700-level literature course in Latin, and one 700-level literature course in Greek. Applicants must have a minimum grade-point average of 3.67 in their Latin, Greek, and classics courses, as well as a 3.50 overall average. Students meeting these criteria may apply to the program by writing to the coordinator for classics and seeking the approval of the classics faculty. Each student admitted to the honors program receives a faculty adviser who is responsible for arranging the student's subsequent program. The faculty adviser will be appointed to teach "Introduction to Classical Scholarship," either Latin 7951 or Greek 795P, depending on the student's classical language of primary interest. The honors student must complete satisfactorily an honors thesis and a final oral examination covering aspects of Greco-Roman studies and classical scholarship. In addition to the course in classical scholarship, the honors student's total program shall include no less than either four 700-level courses in Greek and two 700-level courses in Latin, or four 700-level courses in Latin and two 700-level courses in Greek, depending on which classical language is the object of the student's primary interest and the focus of the student's research course in classical scholarship.

Communication

(For descriptions of courses, see page 190.)

Communication is one of two majors offered in the Department of Theater and Communication. The communication major emphasizes a broad, integrative approach to theories and practices of various forms of communication in three areas: rhetoric and public address, mass media, and communication studies. Coursework relates to the social sciences, the humanities, and to other areas of liberal studies. There is some preprofessional preparation for such vocations as public relations, personnel work, media (electronic, film, print), social services, law, and others.

The communication major consists of ten courses (40 hours) distributed in the following manner:

Required: ThCo 402, 403, and 455; and one course (4 hours) from *each* of the three areas of the major—rhetoric and public address, mass media, and communication studies.

Electives: Four additional courses (16 hours) from among all courses offered for an emphasis. Three of the four additional courses must be at the 600 level or above.

Some interdepartmental coursework or reasonable substitution is possible but must be arranged between the student and his or her adviser.

Students interested in a communication major should consult with the chairperson of the Department of Theater and Communication. Transfer students wishing to major in communication must receive departmental approval.

English

(For descriptions of courses, see page 130.)

The Department of English offers two programs of study: the English major and the English teaching major.

The English Major The English major has two chief objectives: to provide all students with a common core of literary experience and to provide each student with the opportunity of shaping a course of study to suit individual interests. The flexibility and freedom inherent in the second of these objectives places a responsibility upon students to devise a program that has an intelligent rationale. For example, students who intend to pursue graduate study in English literature should choose more than the minimum number of advanced literature courses and should seek a broad, historical background. Students with special interests in linguistics or writing may, on the other hand, wish to elect only the minimum number of advanced literature courses required for the major. All students should secure the assistance and approval of their advisers in formulating an early plan for the major program.

The English department offers a journalism program which, though not a major, prepares students to become professional journalists upon graduation. The program consists of five sequential writing courses which students should begin no later than the second semester of the sophomore year. Internships at daily newspapers are available. Students interested in this program should inquire at the departmental office.

The English department also offers courses for students interested in becoming writers. Up to four consecutive creative writing workshops can be taken in *fiction* or in *poetry*, as well as a course in form and theory of either genre. The instructors for these courses are professional writers. Interested students should inquire at the departmental office.

For the English major, students must complete a minimum of 40 credits of major coursework including: Engl 519, two additional 500-level courses, and seven courses numbered 600 and above. In selecting these courses, students must be sure to meet the following distribution requirements:

1. Two courses in literature prior to 1800: either two advanced courses (numbered 600 or above), or one advanced course and Engl 513.

2. Two courses in literature since 1800: either two advanced courses, or one advanced course and one course from the following list: Engl 514, Engl 515, Engl 516.

Students interested in majoring in English should consult the chairperson.

The English Teaching Major This major is designed for students wishing to teach English in middle or high schools. Completion of this undergraduate major does not in itself, however, meet state certification requirements. To meet these requirements, students should enroll in the undergraduate major and, by September 15 of their senior year, apply for the fifth-year teaching internship and

master's degree program. (For a full description of requirements for the integrated undergraduate-graduate program for teachers, and its several options, see the section entitled "Preparing for Teaching," page 22.) Undergraduate English teaching majors must pass the following English courses with an average of 2.50 or better: Engl 514, 516, 519, 619, 657, 710, 718 or 719, 792, and two additional literature courses numbered 600 or above. Engl 513 may be substituted for the second 700-level course.

Students who are interested in majoring in English teaching should contact Thomas Carnicelli.

French

(For descriptions of courses, see page 137.)

In addition to its value in the context of the liberal arts, the French major provides knowledge of the language, literature, and culture of France which is useful in a number of careers, such as teaching, business, law, and social service. Prospective teachers should consult the section on "Preparing for Teaching," page 22. Students interested in non-teaching careers are urged to consult with members of the French faculty and with other appropriate departments early in their academic careers. Special attention is called to courses in administration offered through the Whittemore School.

A major consists of 36 credits in courses numbered 519 or above, in which readings are in French. Fren 519, 662, and 790 are required of majors. Majors are encouraged to take courses in the literature of other countries as well as in fields such as music, art, philosophy, history, political science, and sociology that provides insight into nonliterary aspects of culture. A minor in French consists of 20 credits in French courses numbered 501 and above (but students may not count both 501 and 503 toward the minor). The chairperson of French supervises the work of both majors and minors.

The department also offers a junior year abroad at the University of Dijon. This program is open to all qualified students at the University of New Hampshire. See Description of Courses, Fren 685-686. Early consultation with the director of the program is urged.

Five-Year, Dual-Degree Program in French and Business Administration The dual-degree program permits students to earn both a B.A. in French and an M.B.A. in business administration in five years instead of the normal six. All requirements for both the French major and the M.B.A. program offered by the Whittemore School of Business and Economics will be met. A maximum of 16 credits may be counted toward both degrees. Students interested in this program should consult with the departmental adviser to the program early in their sophomore year.

Geography

(For descriptions of courses, see page 139.)

Geography is best defined as the discipline that describes and analyzes the variable character, from place to place, of the earth as the home of man. As such, geography is an integrating discipline, studying many aspects of the physical and cultural environment that are significant to understanding the character of areas or the spatial organization of the world.

Geography aims to provide its students with a basis for understanding the world in which we live.

Because its integrating character establishes common areas of interest with many other fields of knowledge, geography provides an excellent core discipline for a liberal education. Those who would understand geography must also know something of the earth sciences, as well as economics, cultures, politics, and processes of historical development.

Students who have a strong interest in the spatial organization of the world and the distinctive character of its major regions and who also want a broad educational experience can achieve these goals effectively by majoring in geography.

Students with degrees in geography have found their education valuable in such fields as urban and regional planning, locational analysis for industry and marketing organizations, cartography, library work, military intelligence, international studies, the Foreign Service, travel and tourism, and journalism.

Students planning careers as scholars or teachers in the field should concentrate their course work in geography and appropriate related disciplines and should plan to go on to graduate study after completing an undergraduate major in geography. Students from this department have been admitted to first-rate graduate schools in all parts of the United States.

Students who major in geography are required to take Geography 401, 402, and seven additional courses in geography or related fields approved by their supervisor to a total of 28 semester credits. The seven courses should include: Geography 570; 572; any two courses in the group 581, 582, or 583; 797; and two additional intermediate level courses in geography.

The department also offers an alternative concentration in urban geography. This concentration consists of six courses drawn from the geography major curriculum (401 or 402, 572, 582, 583, 590, and 797) and at least three additional courses from the following list: Hist 624, Polt 703, and C D 508, 614, and 717.

A minor consists of five courses (20 credits) in geography.

Students interested in majoring in geography should consult with the supervisor, William H. Wallace.

German

(For descriptions of courses, see page 96.)

The German major is offered by the German section of the Department of Ancient and Modern Languages and Literatures. This program is designed to be of interest to the following groups of students:

1. Those who have a special interest in the German language, literature, and culture.
2. Those who intend to enter fields in which a background in foreign languages and literatures is desirable. Examples are: international banking, trade, science, government service, and library science.
3. Those who plan to teach German in secondary schools. Since most secondary schools require their teachers to teach more than one subject, students planning to enter teaching at this level must plan their programs carefully. They should combine a major in one of the languages and its literature with a minor or at least a meaningful sequence of courses in another subject.
4. Those who intend to pursue graduate study in Germanic linguistics and literature. Such graduate study is an essential prerequisite for teaching and research at the university level.

The German section is affiliated with a junior year abroad at the University of Salzburg. This program is open to all qualified students at the University of New Hampshire. See Description of Courses, Germ 685, 686.

A major must include a minimum of 36 credits in German language, literature, and culture beyond Germ 503. Germ 525, 601, 631, 632 (or their equivalents), 656, and twelve other credits on the 700 level earned in Durham are required for all majors. Achievement examinations will be given at the end of the senior year.

Greek

(For descriptions of courses, see page 97.)

The Greek major is offered by the classics section of the Department of Ancient and Modern Languages and Literatures. The supervisor for majors is the coordinator for classics, John C. Rouman.

The minimum requirements for a major in Greek are: 32 credits in Greek, including Greek 401-402. Students are encouraged to take courses in related fields such as Latin, classics, and ancient history, and to take part in overseas study programs in Greece.

For the Honors Program in Classics, see page 26.

History

(For descriptions of courses, see page 141.)

The history major is designed to provide both an awareness of the past and the tools to evaluate and express one's knowledge. Its requirements expose a student to the breadth of the human past, allow concentration in an area of special interest, and offer training in critical reading and writing.

Students majoring in history must complete 32 credits in history courses with a grade of C– or better and an overall average in these courses of 2.00 or better. History 401, Present in Perspective, cannot be used for major credit. History majors must complete History 500, Introduction to Historical Thinking, in the semester following declaration of major. Majors must take History 797, Colloquium in History, during their senior year. In addition to 500 and 797, a major must take at least six courses, of which a minimum of three must be at the 600 level or above. These courses must include a minimum of one semester-course each from Groups I, II, and III listed in the Description of Courses. For transfer students, a minimum of four of the semester-courses used to fulfill the major requirements must be taken at the University of New Hampshire and at least two of these must be numbered 600 or above.

Students intending further work in history beyond the bachelor's degree are urged to take Hist 775, Historical Methods.

Students intending to major in history should consult with the chairperson of the department. Suggested programs for students with special interests or professional plans are available in the department office.

Five-Year, Dual-Degree Program in History and Business Administration The dual-degree program permits students to earn both a B.A. in history and an M.B.A. in business administration in five years instead of the normal six. All requirements for both the history major and the M.B.A. program offered by the Whittemore School of Business and Economics will be met. A maximum of 16 credits may be counted toward both degrees. Students interested in this program should consult with the history department adviser early in their sophomore year.

Humanities

(For descriptions of courses, see page 145.)

The major in humanities allows students to design and pursue under faculty guidance a coherent interdisciplinary program in the humanities (art, drama, language, literature, music, philosophy). The student defines the subject and selects a program of related courses. The subject may be a historical period or any other topic that may be explored through several disciplines in the humanities. The program must have clear educational and intellectual merit and prepare the student to undertake a senior project of at least four credits on the subject (Huma 699). The program must be sponsored by a faculty member from the Humanities Division and approved by the Executive Committee of the division.

Students who wish to become humanities majors should submit a formal proposal to the committee by the end of the sophomore year. Normally, students should have a grade-point average of at least 2.70. Students should select most of the courses for the program from those offered for major credit by departments within the Humanities Division, but they are also encouraged to include courses from outside the division (especially from history) that

are appropriate to the major subject. The number of courses in the program may vary, but at least 32 credits of major coursework must be completed.

Before submitting formal proposals, interested students are urged to seek the advice of committee members and other faculty in the Humanities Division. Inquiries about the humanities major should be directed to Warren R. Brown, coordinator of the Humanities Major Program, 19 Murkland.

Latin

(For descriptions of courses, see page 98.)

The Latin major is offered by the classics section of the Department of Ancient and Modern Languages and Literatures. The supervisor for majors is the coordinator for classics, John C. Rouman.

The minimum requirements for a major in Latin are: 32 credits in Latin, excluding Latn 401-402. Students are encouraged to take courses in related fields such as Greek, classics, and ancient history, and to take part in overseas study programs in Italy.

For the Honors Program in Classics see page 25.

Linguistics

(For descriptions of courses, see page 151.)

Linguistics is the study of one of the most important characteristics of human beings: language; it cuts across the boundaries between the sciences and the humanities. The program is an excellent liberal arts major or preprofessional major for law, medicine, clergy, and others. Dual majors with a foreign language, business administration, and the like, are quite feasible.

Students interested in the major or the minor should consult with the program coordinator, or with any professor who teaches linguistics courses. To declare a major in linguistics, a student must first submit a proposal, signed by a faculty sponsor, to the Linguistics Committee. Information is available from the Advising Center, Murkland Hall.

A minor in linguistics is also available and consists of any five linguistics courses approved by the linguistics coordinator.

Requirements for the Major

1. Ling 505, Introduction to Linguistics
2. Ling 506, Introduction to Comparative and Historical Linguistics; or English 752, History of the English Language
3. Ling 794, Syntax and Semantic Theory
4. Ling 793, Phonetics and Phonology
5. Two years college study (or equivalent) of one foreign language
6. One year study (or equivalent) of a second foreign language from a different language family or subfamily (Old English may count as the second foreign language if the first foreign language is not in the Germanic family); *or*

Psychology 712, Psychology of Language (and its prerequisites); *or*

Philosophy 745, Philosophy of Language (and its prerequisites)

7. Four elective courses from the list below.

Area Courses

*AMLL:*791D, Methodology of Foreign Language Teaching.

Anthropology: 795-796, Anthropological Linguistics.

Classics: 595-596 section H, Sanskrit; section I, Hittite (by arrangement).

Communication Disorders: 524, Applied Phonetics of American English; 638, The Acquisition of Language.

English: 715, Applied Linguistics; 716, Problems in Applied Linguistics; 718, English Linguistics; 719, English Grammar; 752, History of the English Language; 778, Brain and Language; 779, Linguistic Field Methods; 790, Special Topics in Linguistic Theory; 793, Phonetics and Phonology; 794, Syntax and Semantic Theory.

French: 791, Methodology of Foreign Language Teaching.

German: 781, History and Development of the German Language.

Latin: 795, 796, Independent Study.

Linguistics: 505, Introduction to Linguistics; 506, Introduction to Comparative and Historical Linguistics; 790, Special Topics in Linguistic Theory; 793, Phonetics and Phonology; 794, Syntax and Semantic Theory; 795, 796, Independent Study.

Philosophy: 550, Symbolic Logic; 615, Analytic Philosophy; 712, Advanced Logic; 745, Philosophy of Language.

Psychology: 511, Introduction to Perception, Language, and Thought; 712, Psychology of Language; 812, Psycholinguistics.

Russian: 734, History and Development of the Language.

Sociology: 797F, Socio-Linguistics.

Spanish: 601, Spanish Phonetics; 795A, History of the Spanish Language.

Theater and Communication: 572, Language and Behavior; 630, Psychology of Communication; 783, Theories of Language.

Other courses may be substituted, with the permission of students' advisers and the Linguistics Committee, when they are pertinent to the needs of the students' programs.

Microbiology

(For descriptions of courses, see page 158.)

Microbiology explores the fundamental nature of living organisms that cannot be seen by the unaided eye. The primary emphasis is on bacteria and viruses. Such learning is especially valuable to students planning to enter city, state, or federal government service, or positions with universities, research institutes, or industrial organizations. Some students go on for graduate work. The principal areas of concentration in the department are: 1) general; 2) medical; 3) public health; 4) environmental; 5) marine and soil microbiology; 6) microbial cytology and ultrastructure; and 7) virology.

A minimum of 28 semester credits from department offerings must be completed in addition to a course in biochemistry (Bchm 601 or 656). Chem

403-404 should be taken in the freshman year, and Organic Chemistry (Chem 545 or 651-652) is also required. Within the Department of Microbiology, the following core courses are required: General Microbiology (503), and Taxonomy and Ecology (701). For students desiring a strong background in medical microbiology, Pathogenic Microbiology (702), Immunology and Serology (705), and Virology (706) are recommended. For students wishing to emphasize natural processes, the following courses are recommended: Marine Microbiology (707), Microbial Biogeochemistry (708), and Soil Microbiology (712). Environmental Microbiology (600), Microbial Genetics (704), and Microbial Cytology (710, 711, 793) are recommended as courses valuable to microbiology majors. The Problems in Microbiology course (795-796) is available for students by special permission. For students considering graduate school and the microbiology registry exam, courses in mathematics through calculus, physics, quantitative analysis, and introductory courses in botany and zoology are strongly recommended. The courses for each major program are selected to meet the needs of the individual, as determined by the student and the adviser.

Students interested in majoring in microbiology are advised to consult Robert M. Zsigray.

Music

(For descriptions of courses, see page 159.)

The Department of Music offers two degree programs: the Bachelor of Arts and the Bachelor of Music. The Bachelor of Music degree is discussed on page 36.

The Bachelor of Arts program offers students an opportunity to major in music within the liberal arts curriculum. This program is intended for those who wish to pursue the serious study of music and to acquire at the same time a broad general education; it is recommended for those considering graduate study leading to the M.A. or Ph.D. degrees, or the five-year undergraduate-graduate program in teacher education.

To be admitted formally to the B.A. program, students must give evidence of satisfactory musical training by taking an admission audition. Students must declare music as a major before the beginning of the junior year, but it is highly recommended that they declare as early as possible, considering the large number of required courses. Admission to the upper level of the degree program will be subject to review by the Department of Music faculty.

The Bachelor of Arts degree is offered with four options: music history, performance study, music theory, and preteaching. All students must complete a minimum of 32 credits of coursework in music, of which the following are required: Musi 471-472, 473-474, 501-502, 571-572, and 573-574. In addition, the requirements for each option are given below.

Music History Option Advanced theory (4 credits); advanced history and literature (12 credits); any one of 541–550 inclusive (8 credits). Students must also demonstrate the ability to sight-read a Bach chorale harmonization.

Performance Study Option Advanced theory or literature (4 credits); performance study (16 credits—two credits per semester). Qualified students may major in voice, piano, strings, woodwinds, brass, or percussion. Voice majors must successfully complete, in addition to the foreign language requirement, one of the following course sequences: Ital 401-402, Germ 401-402, Fren 401-402.

Music Theory Option Advanced theory (12 credits); advanced history (4 credits); any one of 541–550 inclusive (8 credits). Students must also demonstrate the ability to sight-read a Bach chorale harmonization. The emphasis in this option is on musical composition and/or theory.

Music Preteaching Option MuEd 500; Musi 751-752; Musi 779; techniques and methods (8 credits); 8 credits from Musi 441–453 inclusive; 8 credits from any one of Musi 541–550; piano proficiency. (See page 22, Preparing for Teaching).

A public performance is given during the senior year—for music history majors this must be a lecture or lecture-recital; for performance majors, a full recital; for theory majors, a lecture, lecture-recital, or a recital including at least one original composition; for preteaching majors, a half recital is the minimum. A more detailed description is available from the Department of Music.

All students minoring in music must complete a minimum of 20 credits of coursework in music, of which the following are required: Musi 471-472, Musi 473-474, Musi 501-502. Music 411-412 may be substituted for Musi 471-472 and Musi 473-474.

The Department of Music is a member of the National Association of Schools of Music. Prospective B.A. majors in music are advised to consult with Paul Verrette.

Philosophy

(For descriptions of courses, see page 168.)

Philosophy has always been the heart of liberal education, deepening and enriching the lives of those who pursue it. It is also excellent preparation for a variety of vocational and professional endeavors.

The Philosophy Major The following courses constitute a core required of all majors: 530, 570, 572, 573; and one from 610, 615, 620. Students conscious of a more-than-ordinary interest in philosophy should take these core courses as early as possible.

Beyond the core, majors must select, with their advisers' approval, three additional philosophy courses (exclusive of 699 and 795-796) at or above the 500 level, at least two of which must be at the 700 level, for a minimum of eight courses.

Special-Interest Program Students may add to the above major a special-interest program of value in planning for postgraduate education or entry into such areas as law, medicine, business, education, theology, or social work. Special advisers are prepared to provide informal counsel to philosophy majors interested in these areas.

Graduate Preparatory Emphasis This emphasis is strongly recommended for students who plan to do graduate work in philosophy. Beyond the five core courses, such students should select, with their advisers' approval, six additional philosophy courses above the 400 level, for a total of eleven courses. At least three of these six should be on the 600–700 level (exclusive of 699 and 795-796) and one of them should be 550.

Departmental Commendation Students accepted for departmental commendation will register for 699 (usually during the second semester of the senior year) and will write, under the guidance of an adviser, an original paper in philosophy. If completed successfully, students will receive a letter of commendation.

Students interested in an honors program in philosophy must first meet the eligibility standards set by the College of Liberal Arts and should then contact the department chairperson for information.

Philosophy Minor Any five philosophy courses constitute a minor.

Five-Year, Dual-Degree Program in Philosophy and Business Administration The dual-degree program permits students to earn both a B.A. in philosophy and an M.B.A. in five years instead of the normal six. All requirements for both the philosophy major and the M.B.A. program offered by the Whittemore School of Business and Economics will be met. A maximum of 16 credits may be counted toward both degrees. Students interested in this program should consult the departmental adviser to the program early in their sophomore year.

Political Science

(For descriptions of courses, see page 177.)

The study of politics, to which the courses and seminars of the Department of Political Science are devoted, includes the development of knowledge of political behavior by individuals and groups as well as knowledge about governments: their nature and functions, their problems and behavior, and their interactions—at the national and international levels and at the local, state, and regional levels.

Much of the learning offered by the Department of Political Science can also be regarded as essential for good citizenship, since political knowledge helps to explain both the formal institutions by which societies are governed and the issues that encourage people toward political interest and political action. In addition, such learning is especially valuable to students planning to enter local or national government or other public service, including foreign service, and will be of great help to those who intend to study law and enter the legal profession. For teaching, particularly at the college level, and for many types of government service, graduate work may be indispensable, and an undergraduate major in political science will provide the most helpful foundation for further study in the field. Such an emphasis will also be valuable for students seeking careers in journalism, international organizations, and the public affairs and administrative aspects of labor, financial, and business organizations.

The major program in political science consists of at least nine courses (36 credits) and not more than 12 courses (48 credits), to be distributed in the following way:

1. Two from the offerings at the 400 level. These courses are designed for the introductory level and should be completed by majors by the end of the sophomore year.
2. Six from the offerings at the 500 and 600 levels. Of these, at least one shall be chosen from each of the four fields in which the department's courses are organized: American politics, comparative politics, international politics, and political thought.
3. One from the offerings at the 700 level.

Internships and Advanced Study In addition to the courses regularly offered, the department will have available selected topics, advanced study in political science, and internships. Interested students should check with the department office to learn of the offerings for a given semester.

The department also offers several internship opportunities giving students experience in various aspects of government, policymaking, and the legal system at the local, state, and national levels. Students need not be political science majors, but a student must have taken certain course prerequisites for each kind of internship. In addition, students must have junior or senior standing and normally have a 3.00 average or higher to be eligible for consideration. Washington placements are made either through the Department of Political Science or through the Washington Center for Learning Alternatives; major credit must be arranged through the department.

Departmental Honors: Honors in political science will be awarded to those students who achieve at least a 3.67 average in political science courses and complete satisfactorily an honors thesis. Honor students must also achieve a 3.50 overall average. Students wishing to pursue departmental honors should apply for admission to the honors program during their junior year. Applicants must have completed at least two 400-level courses, five of six 500–600 level courses, two of which must be in the student's primary area of interest, and one 700-level course, in the primary interest area. Students meeting these and the grade-point average criteria may apply to the honors program by identifying a potential faculty sponsor who writes a letter of support to the department's Undergraduate Pro-

gram Committee. Honors students enroll in Political Science 799 and must complete all other major requirements. A major component of the honors program will be the honors thesis.

Psychology

(For descriptions of courses, see page 180.)

The Department of Psychology offers an academic major that aims to provide students with a broad education, while also allowing some specialization. The program exposes students to the scientific study of behavior and encourages an increased understanding of the behavior of humans and animals.

Students majoring in psychology must complete 36 credits, distributed as follows:

1. Psyc 401, 402, and 502
2. At least two, but not more than three, 500-level courses other than Psyc 502. Of these, one must be from group (a) below and one from group (b):
   a) Psyc 511, 521, 522, 531
   b) Psyc 512, 552, 553, 571, 581, 582
3. Three courses (12 credits) from the 700-level departmental offerings. A maximum of 4 credits of externship (Psyc 793 and 794) and independent study (Psyc 795) may be counted.

Transfer students who elect to major in psychology must complete at least 18 credits in the program at UNH to qualify for the degree in the psychology. The distribution of these credits will be determined by the department's academic counselor.

Specific course selections should be discussed with advisers. Exceptions to the requirements for the major require a petition to the department.

Psychology majors planning to go on to graduate study in psychology should include Psyc 703 or 704 among their courses.

The minor in psychology consists of five courses (20 credits), including Psyc 401 and at least two courses at the 500 level or 700 level.

See the department's secretary for further details on the major or minor in psychology.

Advising System Undergraduate advising in the department is conducted jointly by the department's academic counselor and the full-time faculty. The academic counselor has primary responsibility for advising freshman and sophomore psychology majors and is the initial contact for all majors in a state of transition (readmitted, transfer, newly declared students, etc.). The academic counselor assists students in all phases of educational planning and decision making, including preregistration, long-range academic planning, degree and program requirements, and career selection and planning. Junior and senior psychology majors are officially assigned to a faculty adviser with appropriate consideration for student preferences. The advising relationship with a faculty member is designed to encourage refining career and educational decisions.

Five-Year, Dual-Degree Program in Psychology and Business Administration The dual-degree program permits students to earn both a B.A. in psychology and an M.B.A. in five years instead of the normal six. All requirements for both the psychology major and the M.B.A. program offered by the Whittemore School of Business and Economics will be met. A maximum of 16 credits may be counted toward both degrees. Students interested in this program should consult with the departmental adviser to the program early in their sophomore year.

Undergraduate Awards for Majors Each spring the faculty choose two psychology undergraduates as the recipients of the following awards: the Herbert A. Carroll Award for an outstanding senior in psychology, and the George M. Haslerud Award for an outstanding junior in psychology.

Russian

(For descriptions of courses, see page 99.)

The Russian major is offered through the Russian section of the Department of Ancient and Modern Languages and Literatures. It provides students with an opportunity to study one of the world's most important languages, its culture, and its literature. In addition to the intrinsic value of Russian as a liberal arts experience, the Russian major leads to a number of careers, such as teaching, translation and interpreting, government, and foreign service. It is also a valuable asset in preparing for careers in law, business, economics, and international trade, and it can serve as a dual major with business administration, the natural and physical sciences, and other liberal arts fields such as English, history, political science, sociology, philosophy, theater and communication, linguistics, and other foreign languages.

The Russian major consists of a minimum of 36 credits above Russ 503. Specific course requirements are Russ 504, Russ 505-506, Russ 521, Russ 563, Russ 631-632, Russ 691, and Russ 733, plus an additional 6 credits from among other offerings in Russian.

The minor in Russian consists of a minimum of 20 credits above Russian 402 and must include Russ 503-504 and a minimum of one course (at least 2 credits) on the 600-level.

The Russian section organizes for credit an annual summer five-week language seminar in the USSR.

Students wishing to major in Russian should contact Sandi Mayewski in Murkland Hall 16.

Social Work

(For descriptions of courses, see page 185.)

The social work major prepares graduates for professional social work practice within the context of a liberal arts education. It also prepares students for admission to graduate schools of social work and other graduate professional programs in human service professions.

Social work majors pursue a program that deals with the origin, development, and organization of health and welfare institutions; methods of social work practice; and the relationship of the social work professions to contemporary social issues and problems. Social work majors gain direct experience and a better understanding of the field in required participation in a social welfare setting. The details of the field experience will be arranged between the student and the designated faculty.

Social work majors are required to take S S 524, 525, 550, 551, 622, 623, and 640, 641; Soc 601; and one course from each of two designated areas, a listing of which will be provided by the faculty advisers. Students wishing to major in social work should consult with the chairperson, Betty Holroyd Roberts, in Murkland Hall.

Sociology

(For descriptions of courses, see page 188.)

The major in sociology is designed to provide a degree of concentration in the study of society consonant with a broad liberal education. However, those who wish to teach sociology in secondary schools are advised to consult with the chairperson of the Department of Education for additional courses in related subjects and teaching that may be required. Those who wish to pursue a career in social service should consult with the chairperson of that department about additional courses or possibilities for graduate training. Those who wish to enter graduate programs in sociology should consult with their advisers about additional courses, particularly in the areas of theory, statistics, and methodology, that they should take.

Majors must complete a minimum of 36 semester credits with grades of C− or higher in each of these courses and a grade-point average of 2.00 or better in sociology courses (anthropology 625 may be taken and counted as a sociology course). Soc 400 (or 500 or 600), 599, 601, 602, and 611 are required. At least two of the additional major courses must be at the 600 or 700 level (not including 795 or 796). The department recommends that majors select one of three concentrations:

1. General sociology, involving the five core requirements plus additional courses in sociological theory and methods. This concentration is particularly recommended for students who plan to do graduate study in sociology.
2. Social psychology, involving the five core requirements plus additional courses in social psychology.
3. Applied sociology, involving the five core requirements plus additional courses for students interested in applying sociology to such fields as criminal justice, mental health and illness, race relations, the family, and sociological impact assessment.

Students interested in majoring in sociology should consult with the chairperson of the Departmental Committee for Undergraduate Studies in Sociology for guidance in selecting a concentration. It is the responsibility of all sociology majors to obtain the latest information from the department office.

Departmental Honors Honors in Sociology will be awarded to students who achieve, in addition to the regular requirements of the major, at least a 3.67 grade-point average in courses counted toward the major and satisfactorily complete a four-credit senior thesis under the guidance of a faculty member. A 3.50 overall grade-point average is also required. Students wishing to work for honors should inform the undergraduate committee of their intention during the second semester of their junior year, appending their academic record and a statement of the area in which they intend to write their theses.

Spanish

(For descriptions of courses, see page 100.)

The major in Spanish, offered through the Spanish section of the Department of Ancient and Modern Languages and Literatures, is for those students who wish to acquaint themselves more thoroughly with the language, culture, and literature of the Spanish-speaking peoples.

In addition, through the major, students can prepare for practical goals: teaching Spanish in grade or high schools or teaching other subjects in bilingual programs. With advanced degrees, teaching at the college level and engaging in scholarly research or entering such fields as linguistics or library science are career opportunities. Majors gifted in languages may consider the fields of translation and interpretation. With coursework in business, sociology, psychology, speech, etc., Spanish majors may prepare for work in Spanish-speaking areas of the world as well as in bilingual regions of the United States and also with many governmental agencies.

The Spanish section sponsors Junior Year Abroad programs in Spain and Mexico. These are open to majors and nonmajors. Contact the Spanish section for further details.

The major consists of a minimum of 36 credits above 503. Specific course requirements are 1) language and culture: 525 or 526, 601, 631-632; 2) introductory literature: students must take a total of three courses; either the sequence 651-652 or the sequence 653-654, plus one semester from the sequence not chosen, or 650; 3) advanced literature: two courses at the 700 level.

Interested students should talk to the coordinator or undergraduate adviser for Spanish.

Theater

(For descriptions of courses, see page 190.)

Theater as a composite art, reflecting life, is closely related to painting, sculpture, music, dance, literature, and philosophy. One of the two majors offered in the Department of Theater and Communication, the theater major stresses a broad background in the arts within their social framework. Students interested in the creative aspects of speech communication will find an opportunity for personal and preprofessional growth in theater and its drama, with opportunity for independent study of basic theories and personal involvement in active laboratory situations.

The required curriculum for theater majors consists of: ThCo 402, 435, and a minimum of eight hours from each of the three areas (theory/history, design/technical, performance) including ThCo 436 or 438; 459 and 549 and 551, plus one full course or its equivalent from Performance Project and/or Scenic Arts Project. In addition, Senior Seminar and Senior Project (697; 698) are required, plus an additional eight hours (distributed or in one area) at the 600-700 level. The courses applicable to each category are available from the students' advisers.

There are three other course sequences available within the theater major: 1) courses leading to a major that when combined with requirements from the Department of Education qualify students for secondary school certification; 2) courses leading to a major that when combined with the requirements of the Department of Education prepare students for elementary certification with an undergraduate specialization in youth drama; 3) courses leading to a theater major with a concentration in dance. (In order to be eligible to take either of the first two sequences, students must qualify for the five-year certification program in the Department of Education.)

All students interested in majoring in theater should consult with the chairperson of the Department of Theater and Communication. Students wishing to transfer to the University of New Hampshire and major in theater must first have the approval of the department.

Zoology

(For descriptions of courses, see page 194.)

The zoology major is designed to prepare students for graduate study, which ordinarily is required for engaging in professional work in pure or applied zoology. Other students may elect the major, however.

The University's location on tidewater and near the open ocean provides an unusual opportunity for study of marine zoology and marine ecology.

Zoology majors must complete 32 credits from courses in the biological sciences approved by the department with a 2.00 average and at least a C− (1.67) in each course. Minimum requirements for the zoology major are as follows: Chem 403-404; organic chemistry; calculus (Math 425) or statistics; college physics; Zool 412; Bot 411 or 412; Biol 541; Zool 518 or 528; Zool 519, 604, 629 or 728, plus an elective. A suggested sequence of courses follows:

Freshman: Zool 412, Bot 411 or 412, Chem 403-404, and Math 425 (or INER 528).

Sophomore: Zool 518 or 528, Zool 519, Biol 541, Chem 545.

Junior: Zool 604, Phys 401 (and INER 701 if taken in addition to or instead of Math 425).

Senior: Zool 629 or 728, another biological sciences course in zoology or other biological sciences department (may be taken earlier than the senior year).

Students who are interested in a zoology major should consult the supervisor, Edward N. Francq.

Bachelor of Fine Arts Curriculum

(For descriptions of courses, see page 103.)

The Bachelor of Fine Arts curriculum provides training for students who plan to enter professional graduate school or pursue careers as professional artists. The basic unit of nine courses consists of drawing (Arts 432, 532), beginning oil painting (Arts 542), sculpture (Arts 567), sophomore seminar (Arts 598), and four courses in art history. This unit is designed to provide a common body of concepts and techniques and is intended to raise the level of creative achievement for all students in the B.F.A. degree curriculum.

During the junior and senior years, students will concentrate on six courses, two of which must be at the 600 level, in one of the major program areas of the department. The major programs are: 1) painting; 2) sculpture; 3) individualized programs. Individualized programs may be designed in the following subject areas: A) ceramics; B) drawing; C) weaving; D) graphics; E) metalsmithing; F) photography; and G) wood furniture design. Proposals for individualized programs are accepted only by permission of the department chairperson, the major adviser, and the Departmental Bachelor of Fine Arts Faculty Committee. Advanced students will also be required to take three art electives. Finally, each senior will be required to take Arts 798, Seminar/Senior Thesis, which culminates in the mounting of an exhibition of the student's work. (Printed copies of suggested sequences of courses may be obtained from the Department of the Arts. Also, see the following listing.)

The four courses in art history required in this program are used to satisfy partially the University's Group III General Education Requirement.

Candidates applying for the Bachelor of Fine Arts program are required to submit a portfolio.

Suggested Sequences of Courses B.F.A.—Painting

Freshman Year	Fall	Spring
Arts 432, Drawing I	4	—
Arts 483, Art of the Modern World	4	—
Non-Art Academic	8	8
Arts 532, Drawing II	—	4
Arts 546, Oil Painting I, or Arts 544, Water Media I	—	4
Sophomore Year		
Arts 567, Sculpture I	4	—
Arts 533, Drawing III	4	—
Art History Elective	4	—
Non-Art Academic	4	4
Arts 547, Oil Painting II	—	4
Arts 598, Sophomore Seminar	—	4
Art History Elective (500 or above)	—	4
Junior Year		
Arts 646, Oil Painting III or Arts 645, Water Media II	4	—
Art Elective	4	—
Non-Art Academic	8	4
Arts 647, Oil Painting IV	—	4
Arts 796, Independent Study —Painting	—	8

Senior Year

Arts 798, Senior Seminar/Thesis	8	—
Arts 746, Painting V	4	—
Non-Art Academic	4	8
Art Elective	—	4
Art History Elective (500 or above)	—	4

B.F.A.—Sculpture

Freshman Year

Arts 432, Drawing I	4	—
Arts 483, Art of the Modern World	4	—
Non-Art Academic	8	8
Arts 532, Drawing II	—	4
Arts 567, Sculpture I	—	4

Sophomore Year

Arts 568, Sculpture II	4	—
Art History Elective	4	—
Arts 546, Oil Painting I, or Arts 544, Water Media I	4	—
Non-Art Academic	4	8
Arts 667, Sculpture III	—	4
Arts 598, Sophomore Seminar	—	4

Junior Year

Arts 668, Sculpture IV	4	—
Art History Elective	4	—
Non-Art Academic	4	4
Arts 796, Independent Study —Sculpture	—	8
Arts 767, Casting	—	4

Senior Year

Arts 798, Senior Seminar/Thesis	8	—
Art Elective	4	4
Non-Art Academic	4	8
Art History Elective (500 or above)	—	4

Bachelor of Music Curriculum

(For descriptions of courses, see page 159.)

The Bachelor of Music degree program is offered to students who wish to develop their talent in performance, composition, or music education to a high professional level. The program is recommended to those considering graduate study leading to the Master of Music or Doctor of Musical Arts degrees. Prospective majors are advised to consult with Paul Verrette.

To be admitted to the B.M. program, students must demonstrate a high degree of musical competence or significant creative ability during an audition or examination. Selectivity is exercised as appropriate to the professional requirements of each programmatic option. Students must formally declare the B.M. as a degree program before the beginning of the sophomore year. Continuation into the upper level of the program is subject to review by the faculty of the Department of Music.

A public performance is required during the senior year. (For performance majors this must be a full recital; for theory majors, a lecture, lecture-recital, or a recital including at least one original composition; for music history majors, a lecture or a lecture-recital; for music education majors, a half recital is a minimum.) A more detailed description is available from the Department of Music.

The Bachelor of Music curriculum offers concentration in the following areas: option 1, piano; option 2, organ; option 3, voice; option 4, strings, woodwinds, brass, or percussion; option 5, theory (composition); option 6, music education.

Requirements for the degree include: 128 semester credits; a minimum 2.00 grade-point average in all courses completed at the University of New Hampshire; selected General Education Requirements as listed in the following options; and specific curriculum requirements as indicated. Courses are generally to be completed in their arranged sequence.

Students in music education must maintain a minimum 2.50 grade-point average in the major and have a 2.20 cumulative average at the time of application for student teaching (February 15 of junior year).

Freshman Year

All Options: Engl 401, Freshman English; General Education Requirements—selected science (2 courses), selected social science; Musi 471-472, 473-474.

Option 1. Musi 542 (8 credits).

Option 2. Musi 544 (8 credits).

Option 3. Musi 541 (8 credits); Musi 542 (2 credits); Music Laboratory—Choral (2 credits).

Option 4. Performance Study—major instrument (8 credits); Musi 542 (2 credits); Music Lab—instrumental (2 credits).

Option 5. Musi 542 (2 credits); Performance Study—brass (1 credit); Performance Study—woodwind (1 credit), or Techniques and Methods.

Option 6. Performance Study—major instrument (2 credits); Music Laboratory (2 credits); Techniques and Methods (4 credits); MuEd 500; Educ 500.

Sophomore Year

All Options: General Education Requirements—selected social science (2 courses), selected humanities (non-music) (2 courses); Musi 571-572, 573-574.

Option 1. Musi 542 (8 credits).

Option 2. Musi 544 (8 credits).

Option 3. Musi 541 (8 credits); Musi 542 (2 credits); Music Laboratory—choral (2 credits).

Option 4. Performance Study—major instrument (8 credits); Musi 524 (2 credits); Music Lab—instrumental, (2 credits).

Option 5. Musi 542 (2 credits); Musi 501-502; Performance Study—strings (1 credit), or Techniques and Methods.

Option 6. Performance Study—major instrument (2 credits); Musi 501-502; Music Laboratory (2 credits); Techniques and Methods (4 credits).

Junior Year

Options 1-5: General Education Requirements—Foreign language recommended (2 courses).

Option 1. Musi 542 (8 credits); Musi 501-502; Musi 771-772; Musi 455.

Option 2. Musi 544 (8 credits); Musi 501-502; Musi 771-772; MuEd 540 and 741.

Option 3. Musi 541 (8 credits); Musi 542 (2 credits); Musi 501-502; a second foreign language—German, French, or Italian (8 credits); Music Laboratory—choral and/or opera workshop (4 credits).

Option 4. Performance Study—major instrument (8 credits); Musi 501-502; Musi 751-752; Ensemble (2 credits); Music Laboratory—instrumental (2 credits).

Option 5. Musi 771-772; Musi 775-776; Musi 779; Musi 781; Musi 542 (2 credits).

Option 6. Musi 751-752; Musi 779; Performance Study—major instrument (2 credits); Music Laboratory (2 credits); Educ 700; Educ 701; and one social science.

Senior Year

Option 1. Musi 542 (8 credits); Musi 455; Musi 735; two 4-credit courses elected in advanced theory and literature; two 4-credit courses elected outside the Department of Music.

Option 2. Musi 544 (8 credits); two 4-credit courses in liturgical music, organ literature, repertoire and hymnology; two 4-credit courses in music literature and/or advanced theory; two 4-credit courses elected outside the Department of Music.

Option 3. Musi 541 (8 credits); Musi 542 (2 credits); two 4-credit courses in music literature and/or advanced theory; Music Laboratory—choral, ensemble, and/or opera workshop (4 credits).

Option 4. Performance Study—major instrument, (8 credits); two 4-credit courses in music literature and/or advanced theory; two 4-credit courses elected outside the Department of Music; Music Laboratory—instrumental (2 credits); ensemble (2 credits).

Option 5. Musi 773; Musi 777 (6 credits); Musi 542 (2 credits); two 4-credit courses in music literature; two 4-credit courses elected outside the Department of Music.

Option 6. MuEd 787-788; MuEd 791-792; Educ 705; Educ 694; Performance Study—major instrument (2 credits); Music Laboratory (1 credit); General Education Requirement (two courses, foreign language recommended).

All students are responsible for adding electives as needed to total a minimum of 128 credits for graduation.

Bachelor of Science Curriculum in Biology

(For description of courses, see page 107.)

The Bachelor of Science curriculum in biology is an interdepartmental program that permits students considerable specialization while providing them with a broad cultural education.

Degree Requirements

1. At least 128 credits with a minimum cumulative grade-point average of 2.00 in all courses completed at the University of New Hampshire.

2. Completion of the University General Education Requirements, including Engl 401.

Major Requirements

Specific curriculum requirements are presented in detail on page 80.

College of Life Sciences and Agriculture

Kurt C. Feltner, Dean
Robert O. Blanchard, Associate Dean
Emery P. Booska, Assistant to the Dean

Departments and Institute

Animal Sciences
Biochemistry
Botany and Plant Pathology
Entomology
Family and Consumer Studies
Occupational Education
Plant Science
Institute of Natural and Environmental Resources

Degrees, Majors, and Specializations

Bachelor of Arts
Botany and Plant Pathology
Entomology

Bachelor of Science
Animal Sciences
- Animal Industry
- Preveterinary Medicine
- Science

Biochemistry
Biology
Botany and Plant Pathology
Entomology
Family and Consumer Studies
- Child, Family Studies
- Consumer Studies
- General Studies

Nutritional Sciences*
Occupational Education
Plant Science
- General
- Science

(within the Institute of Natural and Environmental Resources)
Community Development
Environmental Conservation
Hydrology
Resource Economics
Soil Science
Wildlife Management

Bachelor of Science in Forestry
(within the Institute of Natural and Environmental Resources)
Forest Resources
- Forest Management
- Forest Science

* This major is pending final Trustee approval.

Purposes and Programs

The objectives of the College of Life Sciences and Agriculture are to give students a fundamental education in the biological, physical, and social sciences and to introduce them to the arts and humanities. In addition, specific technical courses are provided in students' interests and majors.

The college offers three undergraduate degrees: the Bachelor of Arts, the Bachelor of Science, and the Bachelor of Science in Forestry.

Advisory System

A member of the faculty whose area of interest is closely related to the student's is appointed as an adviser to assist the undergraduate in planning his or her academic program.

Undeclared Major

Students may select a major upon entering the college or may wait until registration for the sophomore year. Students who are uncertain about choosing a specific major may remain undeclared during their freshman year. In most cases they should take the following courses, after which they should be ready to declare a major:

Fall	Spring
Chem 403	Chem 404
Bot 411 or Zool 412	Bot 412 or Zool 412
Psyc 401*	Engl 401
AnSc 401, PlSc 421, or FoRs 423 and 425	REco 411*

*or other elective course to meet a Group II requirement.

Undeclared freshmen should explore possible majors by taking courses in the areas or programs that interest them most. They should talk to faculty, students, and their adviser, Dean Blanchard, concerning requirements, job opportunities, etc., in the various programs and should be prepared to declare a major by April when they preregister for the fall semester of the sophomore year.

Honors Program

The College of Life Sciences and Agriculture, through its various departments, offers superior students the opportunity to participate in an honors program that is individually designed to provide added intellectual incentives and opportunities. Participation in the honors program is by invitation of a faculty member with the approval of the department concerned and the dean of the college. It is limited to those students entering the sophomore or junior year with at least a 3.00 grade-point average. The recommending faculty member, his or her department chairperson, and the dean will constitute the student's academic advisory committee. This committee and the student will decide upon a suitable academic program. Departmental and college course requirements may be waived for students in the program, who must, however, complete the same number of credits to graduate as other students in the department.

Combined Programs of Study

In addition to pursuing a single major, students may combine programs of study as follows:
Minors: See page 17 for requirements. See also Interdisciplinary Minors, page 23 and 50.
Second Majors: See page 17.
Dual-Degree Programs: See page 16 for requirements.
Student-Designed Majors: See page 80.
Other combined and interdisciplinary opportunities are described in "Special University Programs," pages 79–83.

Degrees

Bachelor of Arts Students majoring in botany and plant pathology or in entomology may elect to earn either a Bachelor of Arts degree or a Bachelor of Science degree. The degree requirements in the College of Life Sciences and Agriculture for the Bachelor of Arts are almost the same as for a Bachelor of Science plus the addition of a foreign language requirement (see page 16 for B.A. degree requirements).

Bachelor of Science For the Bachelor of Science degree, a total of 128 credits* is required. In addition, students must complete the General Education Requirements found on page 14, obtain a written recommendation for graduation from their adviser and department chairperson, and achieve a 2.00 cumulative grade-point average for all courses taken at the University of New Hampshire.

Some of the courses prescribed in the following degree programs partially fulfill the General Education Requirements. Students should see their adviser for specific information.

Five-Year Program: B.S.-M.B.A. The College of Life Sciences and Agriculture and the Whittemore School of Business and Economics offer a combined five-year program leading to a B.S. in Plant Science and an M.B.A. degree. Information about the program can be obtained from the plant science department or from the undergraduate counselor in the Whittemore School.

Bachelor of Science in Forestry Students majoring in forest resources earn a professional degree designated as a Bachelor of Science in Forestry. See page 44 for information.

* The wildlife management major requires 132 credits.

Career Opportunities

Many professional careers are open for graduates of the college. There are opportunities in resource development and conservation, as well as in agricultural industries. In all departments, students may prepare for further graduate work in their respective fields of interest.

The agricultural industries, food processing firms, and banks employ graduates as price analysts and managers.

State planning and recreation agencies, soil conservation services, the cooperative extension ser-

vices, and private research firms employ rural and urban planners, hydrologists, conservation experts, resource development economists, nursery planners, and landscape gardeners.

The Peace Corps and the Foreign Agriculture Service hire farm production experts, soil and water managers, market analysts, agricultural engineers, teachers, plant and animal breeders, and nutrition specialists.

The federal government and state agencies, universities, health services, and private foundations employ biochemists, geneticists, animal nutrition specialists, plant and animal pathologists and physiologists, veterinarians, foresters, home economists, and entomologists.

Major Programs

Animal Sciences

(For descriptions of courses, see page 102.)

The undergraduate animal sciences program at UNH provides students with fundamental and applied education in large animal management, nutrition, genetics, physiology, pathology, and cell biology. Courses are offered in all areas of dairy and livestock production.

The department maintains a light horse center and offers an equine program with courses in management, equine diseases, equine discipline, and horsemanship specializing in dressage and combined training. Dairy facilities include housing for more than 100 milking-age cows and the Ritzman Nutrition Laboratory, which is nationally known for its research contributions in dairy cattle nutrition. Beef cattle, sheep, and swine are maintained in a new livestock facility at the Burley-Demerritt farm. Extensive poultry facilities also permit research and teaching in poultry science. The animal sciences building, Kendall Hall, is a modern five-story animal research facility. This building houses the New Hampshire Veterinary Diagnostic Lab; an electron microscopy facility; and nutrition, physiology and cell culture labs, all of which provide opportunities for students interested in basic animal sciences.

The program consists of options in (1) animal industry, (2) science, and (3) preveterinary medicine. In addition to satisfying the specific requirements of one of the three options, all animal science majors must complete certain courses to satisfy animal sciences and general University education requirements.

Students in the *Animal Industry Option* often specialize in dairy, horses, livestock, or poultry and are encouraged to take courses in business, computer science, occupational education, and/or communications. This option permits the students to design a curriculum for a particular career; e.g., cooperative extension, vocational education, sales and service, riding instruction, stable management, and production agriculture.

Students in the *Science Option* specialize in nutrition, physiology, genetics, or pathology and are encouraged to take a curriculum that prepares them for the possibility of obtaining advanced degrees in a graduate school program.

The *Preveterinary Medicine Option* is designed to meet the academic requirements of most veterinary schools. Requirements may be met within three years allowing students to apply to veterinary school during their senior year. However, most students finish their senior year, thus allowing more time for electives, concentration in areas of secondary interest, and completion of graduation requirements.

Employers in agriculture prefer to hire an agricultural graduate with extensive knowledge in a related field (e.g., computer science) rather than a graduate in one of these areas with no knowledge of agriculture. Hence, animal sciences students are encouraged to obtain training in a field that complements study in animal sciences. Such areas may include communications, computer science, education, and business and/or management. This is generally accomplished by taking either a concentration of courses or obtaining a minor in your "specialty" area. Attainment of sufficient training in a "specialty" area enhances opportunity for employment. A careers course is offered to help students select and prepare for a particular career area.

Development of optional career goals is important for preveterinary students. Admission to schools of veterinary medicine is highly competitive. Therefore, students in this option are urged to prepare for alternative careers as they complete preveterinary requirements.

All animal sciences majors are required to complete AnSc 401, 406, and 605; Chem 403-404; Engl 501; and Zool 412. In addition, the requirements in one of the three following options must also be completed:

Animal Industry Option Econ 402 or REco 411; Bot 412 or PlSc 421; Math 420, 425, or INER 528; AnSc 501; Bchm 501; AnSc 502 or Micr 503; Zool 504 or 604; AnSc 606, 607, 609, or 614; AnSc 652; and AnSc 710.

Science Option Phys 401-402; Math 425; Math 426 or INER 528; Micr 503; Zool 507-508 or 518-519; Chem 545 or 651; Zool 604; Bchm 656, 601, or 751-752; and one 700-level AnSc course.

Preveterinary Medicine Option Phys 401-402; Math 425; Micr 503; Zool 507-508; Zool 604; Chem 651-652; and Bchm 656.

Biochemistry

(For descriptions of courses, see page 107.)

Biochemistry is the study of chemistry of living things and of life processes. The program in biochemistry provides a fundamental education in chemistry and the biological sciences and includes basic courses in physics and mathematics.

Two curricula are offered to meet the educational requirements of students with differing professional goals.

Biochemistry Curriculum A provides intensive preparation in chemistry and biochemistry and basic courses in botany, zoology, microbiology, and genetics. This curriculum is recommended for students preparing for graduate study or for admission into professional schools of medicine, dentistry, or pharmacy. Students entering the curriculum should register for Chem 405-406, Math 425-426, Bot 411, and Zool 412 in the freshman year.

Biochemistry Curriculum B provides a fundamental education in chemistry and the biological sciences with enrichment in biochemical specialties including medical, analytical, marine, and nutritional biochemistry. It provides a strong educational background for technical employment in research and service programs of universities, medical schools, hospitals, research institutes, and industrial or government laboratories. Students entering this curriculum should register for Chem 403-404, Bot 411, and Zool 412 in the freshman year.

Students interested in a biochemistry major are advised to consult with the department chairperson as early as possible to assure the most effective curricular planning.

Biology

(For descriptions of courses, see page 107.)

The interdepartmental biology major is described in the chapter on Special University Programs.

Botany and Plant Pathology

(For descriptions of courses, see page 108.)

The botany and plant pathology program explores the fundamental nature of plants. Botany graduates with suitable undergraduate backgrounds may enter the field of secondary education or become research technicians. Those students who have an interest in university teaching and/or research, governmental research, and certain kinds of industrial positions should expect to complete graduate education in the field.

The principal areas of concentration in the department are: 1) plant physiology; 2) cell biology; 3) ecology; 4) phycology, 5) freshwater biology; 6) biological oceanography; 7) plant pathology; 8) systematic botany; 9) plant anatomy and morphology; 10) mycology; and 11) morphogenesis.

Two botany and plant pathology degrees are offered: Bachelor of Science and Bachelor of Arts. Candidates for the Bachelor of Arts degree are required to take the following core of botany courses: 411, General Botany, or 412, Introductory Botany (or equivalent); 503, The Plant World; 566, Systematic Botany; 606, Plant Physiology; and 658, Plant Anatomy, or 762, Morphology of Seed Plants. Also required are two botany electives, Zool 412, and one year of chemistry.

Candidates for the Bachelor of Science degree are required to take Bot 411 or 412, 503, 566, 606, 658 or 762, and Bot 601, Terrestrial Plant Ecology. Also required are three botany electives, one of which will be taken in the field of phycology, and one in the field of mycology; Zool 412; one year of general chemistry and either Chem 545, Organic Chemistry, or Bchm 501, Biological Chemistry; and PlSc 604, Principles of Genetics.

These required courses cannot be used to fulfill Group I requirements. Majors must maintain a grade of C− (1.67) or better with a grade-point average of 2.0 in required courses. Beyond that, the program of each individual is selected by the student and adviser to meet particular needs.

Courses recommended to fulfill electives in Groups I and III are: Phys 401-402, Introduction Physics I and II; Math 425-426, Calculus I and II; Micr 503, General Microbiology; and courses in statistics and computer science.

Students interested in majoring in botany and plant pathology are invited to consult with Subhash C. Minocha, chairperson.

Entomology

(For descriptions of courses, see page 134.)

The Department of Entomology offers courses for students who wish to specialize in the study of insects and noninsect terrestrial arthropods, insect pest management, and insects in relation to people. There are employment opportunities for graduates in federal and state agencies, public institutions, and commercial and industrial firms in the areas of crop protection, forestry, conservation, and public health.

Students receive a fundamental education in the major fields of entomology, including general biology of insects and other arthropod groups, forest entomology, economic entomology, medical entomology, insect morphology, physiology, taxonomy, and insect pest management. Those who wish to specialize in chemical control of insects are expected to take courses in mathematics and chemistry. Outstanding students are encouraged to pursue graduate study.

Entomology majors are expected to complete 32 semester credits successfully in courses offered by the department. Courses in other departments may be taken in lieu of the above with the consent of the major adviser. Majors are required to take the following courses: Ento 402, 503, 705; Bot 411 or 412; Zool 412; Chem 403-404 and 545 (and 546) or Bchm 501; plus four courses from the following: Bot 566, 606, 751, 754; INER 528; Micr 501 (and 502) or 503; PlSc 421, 607, 651, 652, 653, 654; Zool 528, 721.

Students may earn either a Bachelor of Science or Bachelor of Arts degree in entomology.

Those contemplating a career in entomology are

advised to consult with the chairperson of the Department of Entomology.

Family and Consumer Studies

(For descriptions of courses, see page 135.)

The objective of the family and consumer studies program is to provide specialized instruction as preparation for professional careers in which the interests and well-being of the individual, the consumer, and the family are paramount.

The department provides professional preparation for men and women through two options: 1) child, family studies; 2) consumer studies.

The department has been approved by the New Hampshire State Board of Education for the preparation of nursery-kindergarten teachers. Requirements for professional programs make it advisable to specify an option as soon as possible.

Candidates for the degree of Bachelor of Science must complete 32 courses or a minimum of 128 credits with an average of C (2.00) or better; a grade of C- (1.67) or better is required in all courses taken to meet departmental and professional requirements. Professional requirements include a minimum of nine courses (36 credits) in FCS courses. Undergraduates are required to take two courses (8 credits) from each of the two program areas (child, family; consumer studies). Upon selection of a program option, students, in consultation with their advisers, will select the remaining five courses (20 credits) from among those offered in the department that relate to their particular field of interest. In addition, students are required to take a minimum of seven approved courses (28 credits) in related fields, selected in consultation with their adviser. These courses may help students meet certification standards of preschool teaching, secondary school teaching, family life internships, and other career objectives.

Students seeking nursery-kindergarten teacher certification or family internships must apply to the department for acceptance into these programs by spring semester of the junior year. Students seeking secondary home economics certification must apply through the Department of Education. See page 22.

Students wishing to major in the Department of Family and Consumer Studies are advised to consult with the administrative assistant as early as possible.

General Studies

General studies is a flexible curriculum for students with a broad, general interest in several areas of life sciences and agriculture. It cuts across departmental lines and in some respects resembles a self-designed major. It is not intended to be a catch-all for students from other colleges but is designed to serve the needs of Life Sciences and Agriculture students. Students majoring in general studies should take Chem 403-404, Zool 412, and Bot 411, 412, or PlSc 421. Six additional courses in the college (or closely related courses approved by the adviser), two of which must be at the 600-level or above, are required. These courses should be interrelated in such a way that they will help students meet their goals for employment or further study.

Freshmen who are unsure of a major should not declare general studies as a major but should remain undeclared for a semester or two. See p. 39.

Institute of Natural and Environmental Resources

(For descriptions of courses, see page 145)

The Institute of Natural and Environmental Resources (INER) is a multidisciplinary unit with approximately 25 faculty and 600 students in seven undergraduate and six graduate programs. The seven undergraduate programs are: Community Development, Environmental Conservation, Forest Resources, Hydrology, Resource Economics, Soil Science, and Wildlife Management.

All students who register for courses in INER that have laboratories or field activities will be required to present evidence of medical or accident insurance providing coverage of medical expenses in case of injury.

The majors of the Institute of Natural and Environmental Resources have been reorganized into two new departments: the Department of Forest Resources and the Department of Resource Economics and Community Development. That change is not reflected in this catalog; therefore, students should confer with their advisers about program and courses.

Community Development

(For descriptions of courses, see page 147.)

The Community Development Program deals with broad aspects of community problem resolution, including economic, social, political, and technical matters. Communities are viewed as systems subject to meaningful analysis, and emphasis is placed on the community development process of helping people learn how to work together, organize their efforts, and analyze community problems in a democratic, decision-making framework. The curriculum takes an interdisciplinary approach and includes field experience as a vital component, along with classroom and independent study.

The core courses in the curriculum provide students with the basic community development tools. Flexibility is added through electives that permit students to specialize and develop strong minors in areas such as conservation, planning, education, administration, pollution and waste disposal, natural resource management, or resource economics. Opportunities are available for field experience.

Local communities are turning to individuals trained to view the big picture, since the problems and opportunities facing localities are varied. Those with a background in the arts and sciences and their practical application are in demand by both public and private local groups concerned with community planning and development. While this program is suitable for preparing citizens for more effective leadership in their local community, em-

ployment opportunities are available in the United States, Canada, and in emerging nations.

Students interested in a community development major or minor may consult with the program coordinator, Albert E. Luloff, James Hall, or with the director of the institute.

Required Courses

I. All of the following (16 credits):

C D 507	Introduction to Community and Community Development
C D 508	Applied Community Development
INER 528	Applied Statistics or its equivalent
C D 795-796	Independent Investigations in Community Development

II. One of the following (4 credits):

REco 506	Population, Food, and Resource Use
Geog 583	Urban Geography

III. At least 8 credits of the following:

REco 606	Land Economics and Use
C D 614	Community Planning
C D 627	Community Economics and Financing
C D 628	Community Conflict and Consensus
C D 710	Community Development Seminar

IV. One of the following (4 credits):

C D 705	Planned Change in Nonmetropolitan Communities
C D 717	Law of Community Planning

V. Two courses from two of the following groups (at least 6 credits):

A: INER 702, INER 709, or Biol 541
B: Soc 560 or Soc 745
C: Admn 712 or Admn 713

VI. Required of all INER majors:

INER 400	Introduction to the Institute of Natural and Environmental Resources

Courses to Satisfy General Education Requirements

Biological and Physical Sciences and Mathematics:

Math 420	Fundamental Mathematics
Bot 411 or Zool 412	General Botany or Principles of Zoology

Two additional courses selected by student

Arts, Humanities, and Social Sciences:

REco 411	Introduction to Resource Economics
Arts 455	Introduction to Architecture
Soc 500	Introduction to Social Psychology
Engl 501	Introduction to Prose Writing

Two additional courses selected by student

Outside major department:

Engl 401	Freshman English
ThCo 403	Public Speaking

Four additional courses selected by student

C D Minor Requirements:

C D 507	Introduction to Community and Community Development
C D 508	Applied Community Development
C D 795-796	Independent Investigations in Community Development

One additional course selected from C D Group III.
One additional course selected from C D Group IV.

Environmental Conservation

The program in environmental conservation gives a broad background for understanding environmental and resource problems and their solutions. Economic activity within our biological ecosystems requires understanding of both subject-matter areas, and development of policies and planning is essential to resolving environmental problems.

Students must develop a concentration related to career goals. The concentration consists of eight courses selected with the assistance of the faculty adviser from the offerings of the University. Concentrations center on a variety of conservation-related areas, such as land-use planning, ecological education, pollution control, writing about natural resources, etc. In addition, students must complete the 12 courses listed below, which make up the core of the environmental conservation program.

A minor of five courses in environmental conservation is available for students majoring in other areas. Permission is required.

The following 12 courses are required of all majors:

INER 400*	Introduction to the Institute of Natural and Environmental Resources
Bot 411 or	General Botany
Bot 412	Introductory Botany
Zool 412	Principles of Zoology
Ecology electives	Two of the following: Biol 541, General Ecology; Bot 601, Terrestrial Plant Ecology; Bot 742, Physiological Ecology; FoRs 527, Silvics; FoRs 634, Wildlife Ecology; FoRs 672, Ecological Energetics; Zool 732, Soil Zoology
REco 411	Introduction to Resource Economics
Economics elective	One of the following: REco 676, Economics of Water Use and Quality Management; REco 606, Land Economics and Use; REco 611, Marine Resource Economics; REco 706, Economics of Resource Development; FoRs 544, Forest Economics; Econ 668, Economic Development
INER 635	Contemporary Conservation Issues
INER 702	Natural Resources Policy
Hydr 504	Freshwater Resources
INER 637	Practicum in Environmental Conservation: 4 credits. This practicum will be an independent project involving field work on an actual conservation activity during the senior year. A written report will be required. The project may be developed with any faculty member in the Institute of Natural and Environmental Resources.
Speaking or writing course	A speaking skills course or a writing skills course (beyond Freshman English)

*Required of all INER majors.

Students should plan to work for a master's degree if they wish to be professional conservationists. The undergraduate degree offers an education in environmental conservation with the opportunity for specialization or generalization in related fields.

All students must complete the University General Education Requirements.

Students interested in a major may consult with the program coordinator, John Carroll, James Hall, or with the director of the institute.

Forest Resources

(For descriptions of courses, see page 148.)

The Forest Resources Program has the objective of combining a basic education with technical forestry education to meet the needs of professional foresters.

Professional foresters are employed in a variety of forest-land management and wood utilization positions. Some graduates work with natural resource protection and the improvement of environmental quality. Others are employed in the production and utilization of raw materials; still others become involved with wildlife, watershed, and recreation management. There are rapidly expanding opportunities in urban forestry.

Managerial and administrative skills are required of most professional foresters. This program provides a foundation in biological knowledge and managerial skills, with elective freedom to cultivate special abilities and interests. The curriculum leads some students into graduate studies, for which they have been prepared in the undergraduate program.

Students majoring in forest resources complete 143 credits for the degree of Bachelor of Science in Forestry. The University's General Education Requirements are met by taking the required courses listed in the accompanying chart and by choosing electives from the following: five courses in the arts, humanities, and social sciences; and four courses other than those listed under forest resources.

In addition to the normal University fees and tuition, forest resources students are required to pay certain course transportation fees and the cost of meals in connection with some planned field sessions.

All of the following freshman and sophomore courses, or their equivalents, must be completed before entry into any of the junior and senior forestry courses: Dendrology, Identification of Trees and Shrubs, Freshman English, General Botany, Calculus I, Wood Science and Technology, Principles of Economics, Writing, Silvics, Soils and the Environment, Computer Methods, Applied Statistics, Forest Economics, and Forest-land Measurement and Mapping. Junior and senior forestry program courses include: Silviculture, Forest Fire Protection, Forest Mensuration, Forest Resources and Measurement Mapping, Forest Management, Forest Resource Management Seminar, and Wood Products Manufacture and Marketing.

In addition to these formal courses, all forestry majors are required to have at least one summer of forestry work experience (FoRs 500). Students are responsible for their own summer work, though assistance is available from the faculty.

Before the junior year, students must choose a single area of concentration from the following options, and must earn 24 credits within that concentration.

Forest Management Option This option is designed for students who intend to develop a career in forest resource management. Requirements: FoRs 753, Operations Analysis; one course in administration, 500 level or higher; four courses (16 credits) in advanced forestry, wildlife, hydrology, soils, resource management, urban forestry, or administration.

Forest Science Option In this option students may prepare for specialization in specific forest sciences, primarily as background for entry to graduate study. There are concentrations identified in three areas: biological science, wood science, and quantitative science. Specific course requirements will be established by the forestry faculty.

Freshman Year		Fall	Spring
INER 400*	Introduction to the Institute of Natural and Environmental Resources	0	—
FoRs 400†	Orientation in forestry	0	—
FoRs 423	Dendrology	2	—
FoRs 425	Identification of Trees and Shrubs	2	—
FoRs 426	Wood Science and Technology	—	4
Engl 401	Freshman English	4	—
Bot 412 or 411	Introduction to Botany or General Botany	(4)	4
Math 425	Calculus I	4	—
REco 411 or Econ 401	Introduction to Resource Economics or Principles of Economics	(4)	4
Engl 501	Prose Writing	—	4
Elective	(Group II or III)	4	—
		16	16
Sophomore Year			
FoRs 527	Silvics	4	—
Soil 501	Soils and the Environment	4	—
Chem 403	General Chemistry	4	—
Science Elective	Chem 404, ESci 401, or Phys 401	—	4
Ento 506	Forest Entomology	—	4
INER 528	Applied Statistics I	—	4
FoRs 544	Forest Economics	—	4
INER 511 (or C S 403)	Computer Methods in Natural Resources or Introduction to Digital Computer Programming	—	2
FoRs 542	Forestland Measurement and Mapping	—	2
Elective	(Group II or III)	8	—
FoRs 500‡	Summer Work Experience	0	—
		20	20

Junior Year			
FoRs 629	Silviculture	3	—
FoRs 644	Forest Mensuration	—	4
FoRs 652	Forest Resources Measurement and Mapping	—	2
FoRs 660	Forest Fire Management	—	2
Electives	(Group II or III)	8	4
Option	(Management or Science)	8	6
		19	18
Senior Year			
FoRs 745	Forest Management	4	—
FoRs 798	Forest Resource Management Seminar	—	4
FoRs 754	Wood Products Manufacture and Marketing	—	4
Bot 753	Forest Pathology	4	4
Electives	(Group II or III)	4	4
Option	(Management or Science)	6	4
		18	16

*Required of all INER majors.
†FoRs 400 is required of all forestry majors.
‡Open to all classes, may be repeated.

Students interested in the forest resources program may consult with Richard Weyrick, assistant director for forestry affairs, INER, or the institute director.

Hydrology

(For descriptions of courses, see page 149.)

Hydrology is the science underlying development and control of water resources on and beneath the earth's surface. Because water is a basic requirement of life, it has social, economic, and political significance throughout the world. As the population of the world grows, and as industrial, recreational, agricultural, and residential needs for water increase, greater emphasis will be placed on the study and understanding of problems associated with water resources.

Core courses expected of majors are:

INER 400*	Introduction to the Institute of Natural and Environmental Resources
Chem 403-404	General Chemistry
Phys 407-408 or	General Physics I and II
Phys 401-402	Introduction to Physics I and II
Bot 411 or 412 or PlSc 421	General or Introductory Botany Concepts of Plant Growth
C S 410	Introduction to Computer Programming
Geog 473	The Weather
Math 425, 426	Calculus I and II
ESci 401	Principles of Geology I
Soil 501	Soils and the Environment
ESci 561	Geomorphology
Math 527 or INER 528	Differential Equations with Linear Algebra Applied Statistics I or equivalent
INER 757	Basics of Remote Sensing
Hydr 603	Hydrology and Water Management
Hydr 705	Principles of Hydrology
Hydr 710	Groundwater Hydrology

*Required of all INER majors.

Students interested in the hydrology program may consult with the program coordinator, Gordon Byers, Pettee Hall, or with the institute director.

Resource Economics

(For descriptions of courses, see page 150.)

This program offers training in resource economics, including public resource policy, resource management, natural resource economics, and community economics and finance. Training is also available in agricultural economics, including farm management, food marketing, agricultural policy, and world food supplies.

Students majoring in resource economics will normally concentrate in one of the following three areas: natural resource economics, agricultural economics or community economics. In addition, students must satisfy General Education Requirements, which lead to a broad university education. Majors interested in the economic or business aspects of agriculture will be expected to take courses in the animal sciences and plant science departments.

Students majoring in the social sciences and life sciences and agriculture departments of the University may find it to their advantage to elect courses or a minor in resource economics. By doing so, their basic training can be supplemented in a specific area of interest, such as farm management and agricultural marketing for agricultural majors, resource development and natural-resource policy for social science majors, and community economics and finance for students interested in local government and development.

Required Courses

All of the following:

Engl 401	Freshman English
Soc 400 or Polt 401	Introductory Sociology* Politics, Morality, and Community*
ThCo 403	Public Speaking
Admn 403 or 517	Financial Accounting, or Survey of Basic Accounting
Bot 411	General Botany*
Zool 412	Principles of Zoology*
Soil 501 or Hydr 504	Soils and the Environment* Freshwater Resources*
INER 400†	Introduction to the Institute of Natural and Environmental Resources
REco 411	Introduction to Resource Economics
Math 420 or 425	Fundamental Mathematics or Calculus I
Econ 605	Intermediate Microeconomic Analysis
Econ 611	Intermediate Macroeconomic Analysis
INER 528 or INER 701	Applied Statistics I Statistical Methods I

At least six of the following, of which two must be 700 level:

REco 501	Agricultural and Natural Resource Product Marketing
REco 504	Management of Farm and Related Resource-Based Business

REco 506	Population, Food, and Resource Use in Developing Countries
REco 606	Land Economics and Use
REco 611	Marine Resource Economics
REco 627	Community Economics and Finance
REco 676	Economics of Water Use and Quality Management
REco 706	Economics of Resource Development
REco 710	Resource Economics Seminar
REco 756	Regional Economic Analysis
REco 795-796	Investigations in Resource Economics
INER 615	Linear Programming Methods

*or equivalent to satisfy General Education Requirements
†Required of all INER majors.

Students who major in resource economics are qualified for a wide variety of opportunities upon graduation. Private business, public institutions, and government agencies currently have a strong demand for specialists trained in agricultural, fisheries, and forestry marketing; conservation resource development, community development, and land-use policy; extension work; resident teaching; and farm management. In many cases, students may wish to improve their qualifications by pursuing more specialized graduate studies in one or more of the above areas.

Students interested in a major or minor in resource economics may consult with the program coordinator, Edmund F. Jansen, Jr., James Hall, or with the institute director.

Soil Science

(For descriptions of courses, see page 151.)

Soil science is the study of the physical, chemical, and biological properties of soils, their classification and management in both rural and urban environments, and their essential role in food and fiber production.

Graduates of the soil science program are qualified for many government and private-sector positions. The increasing urbanization of the Northeast has created a demand for soil scientists competent to advise on soils considerations in planning and development, and there is a growing role for soil scientists working with plant scientists and foresters.

Required courses

INER 400*	Introduction to the Institute of Natural and Environmental Resources
ESci 401	Principles of Geology I
Bot 412	Introductory Botany
Bot 606	Plant Physiology
Chem 403-404	General Chemistry
Chem 406, 407	Quantitative Analysis
Soil 501	Soils and the Environment
Soil 602, 702	Chemistry of Soils
Soil 704	Soil Classification and Mapping

at least eight of the following (or equivalents):

Phys 407-408	General Physics I and II
Math 425-426	Calculus I and II
C S 410	Introduction to Computer Programming
ESci 762	Glacial Geology
Micr 712	Soil Microbiology
CiE 665	Soil Mechanics
INER 528	Applied Statistics
INER 711	Statistical Methods II
INER 757-758	Remote Sensing
Soil 502	Soil-Plant Relationships
Soil 601	Soil Morphology
Soil 605	Forest Soils
Soil 614	Soil Management
Soil 795-796	Independent Studies

*Required of all INER majors.

Students interested in the soil science major should consult with Nobel K. Peterson or with the institute director.

Wildlife Management

The wildlife management curriculum is for students whose interest is in the understanding, production, management, and utilization of game and other forms of wildlife. The curriculum provides a knowledge of wildlife species and of the total forest and field environment of which they are a part. It also prepares students for possible employment with public and private agencies in wildlife management and ecology, and is a base for graduate study, which is needed for research and teaching.

The degree earned is a Bachelor of Science with a major in wildlife management. The program, administered in the Institute of Natural and Environmental Resources, is operated in cooperation with the animal sciences and zoology departments.

Field work is carried out during the academic year on wildlife areas near the campus. Each June, a two-week session is held for all students who have completed the sophomore year. There is no additional summer camp. In addition to the normal University fees and tuition, students are required to pay transportation and meal charges in connection with regularly planned field sessions. Majors are encouraged to obtain summer employment related to their career objective.

Freshman Year		Fall	Spring
INER 400*	Introduction to the Institute of Natural and Environmental Resources	0	—
Bot 411	General Botany	4	—
Engl 401	Freshman English	4	—
FoRs 423	Dendrology	2	—
FoRs 425	Identification of Trees and Shrubs	2	—
Math 420 or Math 425	Fundamental Mathematics or Calculus I	—	4
Zool 412	Principles of Zoology	—	4
REco 411	Introduction to Resource Economics	—	4
Electives		4	4
		16	16
Sophomore Year			
AnSc 501	Animal Anatomy and Physiology	4	—
INER 635	Contemporary Conservation Issues	4	—

Chem 403-404	General Chemistry	4	4
INER 528	Applied Statistics I	—	4
Zool 542	Ornithology	—	4
Electives		4	4
		16	16
Spring Field Session (June)			
FoRs 542	Forestland Measurement and Mapping	—	2
Junior Year			
Bchm 501	Biological Chemistry	4	—
Zool 712	Mammalogy	4	—
Polt 401	Politics, Morality, and Community		
or 402	American Politics and Culture	—	4
FoRs 634	Wildlife Ecology	—	4
AnSc 614	Diseases and Parasites of Wildlife	—	4
Biol 541	General Ecology	4	—
C S 403 or	Introduction to Digital Computer Programming		
INER 511	Computation Methods in Natural Resources	2	—
Electives		4	4
		18	16
Senior Year			
FoRs 737, 738	Game Management I and II	4	4
Zool 711	Natural History of Cold-blooded Vertebrates	4	—
Zool 772	Fisheries Biology	—	4
Electives		8	8
		16	16

*Required of all INER majors.

Students interested in the wildlife management major may consult with the program coordinator, William Mautz, Pettee Hall, or with the institute director.

Nutritional Sciences

(For descriptions of courses, see page 165.)

The science of nutrition is the study of the nutrients in food and the body's handling of these nutrients. As an applied science, nutrition is based mainly on biochemistry and physiology and also encompasses aspects of other sciences such as anthropology, economics, genetics, mathematics, microbiology, pathology, animal sciences, and zoology. Consequently, the nutritionist must cooperate with workers in many different fields. The integrated nutrition program at UNH is designed to permit specialized study in human and/or animal nutrition.

Students interested in careers in the nutritional sciences are required to complete a core of basic courses in the biological and physical sciences while taking specialized courses in nutrition. This curriculum plan, which has been approved by the American Dietetics Association (ADA), prepares the student to apply for a dietetic internship while meeting the requirement for a B.S. degree in nutritional sciences. Completion of such an internship is recommended for advanced membership in the ADA and is a requisite for employment opportunities in clinical dietetics and community nutrition. The curriculum plan will also allow students to receive a B.S. degree in nutritional sciences while fulfilling requirements for admission into graduate programs in biological research, medical school, and schools of dentistry.

Core Requirements
Chem 403-404, 545-546 or 651-652
Zool 507-508 or 518-519
Engl 401 and 501
Bchm 656 or 751-752
Nutr 605 plus 12 additional credit hours from recommended courses in nutrition

Occupational Education

(For descriptions of courses, see page 166.)

The occupational education department provides professional preparation for teachers of vocational-technical education, County Cooperative Extension personnel, and others in adult education. Flexibility is maintained among individual programs, with credits being allowed for qualified students under the Occupational Competency Testing and Evaluation program and through participation in field experiences.

Career choices are varied. Graduates of occupational education teach in nearly all areas of vocational-technical education.

Students desiring to major or minor in occupational education should consult with the department chairperson, W. H. Annis.

Plant Science

(For descriptions of courses, see page 176.)

Students interested in plants and their use for food, feed, fiber, recreation, or ornamental purposes may major or minor in plant science. A core curriculum of physical and biological sciences is required. Students may then select courses that relate these sciences to their specific interests. Two curriculum options, the science option and the general option, are offered to plant science majors. The following courses or their equivalents are required for these options:

		Science Option	General Option
PlSc 421	Concepts of Plant Growth	x	x
PlSc or Zool 604	Principles of Genetics	x	x
PlSc 606 or Bot 606	Plant Physiology	x	x
PlSc 566, 607, 651, 652, 653, 654, or 678	Elective in Crop Production		x
PlSc 672	Plant Propagation	x	x
PlSc 795 or 796	Elective in Special Topics	x	
Math 425-426	Calculus I and II	x	

Phys 401-402	Introduction to Physics I and II	x	
Chem 403-404	General Chemistry	x	x
Chem 545-546	Organic Chemistry	x	
Chem 545-546 or Bchm 501	Organic Chemistry or Biochemistry		x
Micr 503	General Microbiology	x	
Ento 402	Introductory Entomology	x	x
Soil 502	Soils and the Environment	x	x
Bot 412	Introductory Botany	x	x
Bot 751 or 753	Plant Pathology or Forest Pathology	x	x
INER 528 or 701	Statistics	x	

Because of the diversity of employment possibilities, the general option curriculum is flexible. Students will find opportunities in management of farms, greenhouses, golf courses, or nurseries; teaching; journalism; park or highway planning commissions; sales or brokerage aspects of wholesale and retail marketing; and food and feed processing firms. Students should pursue the science option to prepare for graduate study and careers in research or teaching. Minor programs in administration, economics, English (journalism), recreation and parks, or occupational education can be tailored to accommodate specialized interests and complement fundamental requirements.

Students interested in a plant science major or minor may consult with the department chairperson, Owen M. Rogers.

A five-year dual-degree program leading to a B.S. degree in plant science and an M.B.A. degree (business administration) is available. Superior students preparing for a business career in agricultural enterprises should notify the department of their interest in their sophomore year. They will be considered for Graduate School enrollment in their junior year.

College of Engineering and Physical Sciences

Otis J. Sproul, Dean
Donald W. Melvin, Associate Dean

Departments

Chemical Engineering
Chemistry
Civil Engineering
Computer Science
Earth Sciences
Electrical and Computer Engineering
Mathematics
Mechanical Engineering
Physics

Programs of Study

Bachelor of Science

Chemical Engineering*
  Energy
  Environmental Engineering
Chemistry*
Civil Engineering*
  Environmental Engineering
  Constructed Systems
Computer Science*
Electrical Engineering*
  Computer Engineering
  Electrical Engineering Systems
  Student-Designed Option
Geology*
Mathematics*
Mathematics Education*
  Elementary
  Secondary
Mathematics (Interdisciplinary)
  Mathematics—Chemistry
  Mathematics—Computer Science
  Mathematics—Economics
  Mathematics—Electrical Science
  Mathematics—Fluid Dynamics
  Mathematics—Mechanics
  Mathematics—Statistics
  Mathematics—Thermodynamics
  Mathematics—Physics
Mechanical Engineering*
  Energy
Physics*

Bachelor of Arts

Chemistry
Chemistry and Physics Teaching
Earth Science Teaching
Geology
Mathematics
Physics
Science†

Bachelor of Engineering Technology

Electrical Engineering Technology
Mechanical Engineering Technology

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*Designated degree (the name of the specialization is included on the diploma; e.g., B.S. in Chemistry)
†Science Major: must declare an area of concentration; e.g., Chemistry, Earth Sciences, Mathematics, Physics.

Purposes and Programs

The College of Engineering and Physical Sciences seeks to provide an optimal opportunity for students to achieve educational objectives appropriate to their interests in engineering, mathematics, and the physical sciences. The college offers a vigorous professional education in each of its nine primary disciplines leading to the Bachelor of Science, and a broad liberal education coupled with majors in mathematics and each of the three physical sciences leading to the Bachelor of Arts. All programs include an opportunity for study in the arts, humanities, and social sciences.

The key to an undergraduate program in the college is flexibility, with a strong emphasis on personal and individualized education. In addition to specific programs, a number of suboptions are available. Special programs can be developed to meet the specific interests of individual students.

Math 425 and 426 or the equivalent in transfer credits or advanced placement approved by the Department of Mathematics are required by all departments of the college for their majors.

Accreditation

The baccalaureate-level programs in Chemical, Civil, Electrical & Computer, and Mechanical Engineering as well as the Engineering Technology program in this college are accredited by the ABET (Accreditation Board for Engineering and Technology).

Degrees

Bachelor of Science

The programs leading to the Bachelor of Science degree, offered in each of the departments of the college, emphasize the preparation of students for a professional career and continuing or graduate education.

The degree requirements for the Bachelor of Science include the University General Education Requirements (page 14) and the specific departmental requirements for graduation. A minimum grade-point average of 2.00 must be achieved. Graduation credit requirements established by the departments range from 128 to 137. There are enrollment limitations in some programs, and it is not possible to guarantee all change of major requests.

Bachelor of Arts

Programs leading to a Bachelor of Arts degree are offered in the departments of chemistry, earth sciences, mathematics, and physics. These programs provide a broad liberal education along with a major in one of these fields. Students interested in science, but undecided about the field, may enter the college as a science major. However, the student must indicate what area of concentration he or she wishes to follow; e.g., chemistry, earth sciences, mathematics, physics. The University requirements for the Bachelor of Arts degree are on page 16.

Bachelor of Engineering Technology

The Engineering Technology program emphasizes applied engineering in two curricula, electrical and mechanical technology. The program enables the student with an appropriate associate degree from an accredited technical institute to obtain a B.E.T. degree in electrical or mechanical engineering technology in two years at UNH. This program emphasizes design and applications and uses the latest techniques and equipment. Student projects and liaisons with New Hampshire industries further enrich the program.

Five-Year Program: B.S.-M.B.A.

The College of Engineering and Physical Sciences and the Whittemore School of Business and Economics offer a joint program leading to a Bachelor of Science (B.S.) in chemical engineering, civil engineering, electrical engineering, or mechanical engineering and a Master of Business Administration (M.B.A.) in five years rather than the normal six. In order to receive both degrees in five years, students in the program may have to take more than 16 credits per semester in several semesters (though no more than five courses or 20 credits). Provision has been made to count 14–24 credits toward both undergraduate and graduate degree requirements. All other University and departmental requirements for each degree must otherwise be met.

The program first "pre-admits" qualified students to take one M.B.A. course in each semester of their junior year. The pre-admission process should be completed by April 1 of the sophomore year. The program is carried out jointly by representatives from the Whittemore School and the College of Engineering and Physical Sciences. Juniors enrolled in the program should submit a formal application to the Graduate School (in the second semester of the junior year) in order to be admitted to the M.B.A. program by March 1; they will be judged by academic standards with special emphasis on maturity and experience.

Most of the fourth year is occupied by core M.B.A. courses, while the fifth year is used for M.B.A. electives (some of which might be taken in the undergraduate major department) and for completing all requirements for the undergraduate degree. The M.B.A. will be granted only if the bachelor's degree requirements are successfully completed.

The details of each student's curriculum are worked out jointly with the departmental undergraduate B.S. adviser and with an adviser for the M.B.A. program.

Undergraduate advisers: Stephen S.T. Fan, chemical engineering; Robert Henry, civil engineering; Fletcher A. Blanchard, electrical and computer engineering; Godfrey Savage, mechanical engineering. M.B.A. advisers: George Abraham, Barbara Coakley, Whittemore School.

Interdisciplinary Minors

Interdisciplinary minors have been developed in ocean engineering, oceanography, biomedical systems and instrumentation, environmental engineering, and materials science. These programs will enable students to obtain experience in the spe-

cialized area and to retain identification with their major professional area. (For University requirements, see page 17.)

Ocean Engineering

The ocean engineering minor recognizes undergraduate engineering students who acquire a nucleus of knowledge about engineering pertaining to the ocean and the coastal zone.

In addition to meeting the University minor requirement of 20 semester hours, students must complete satisfactorily a minimum of five courses from the following list: ESci 501, Introduction to Oceanography; ESci 752, Chemical Oceanography; ESci 758, Introduction to Physical Oceanography; ESci 759, Geological Oceanography; E E 781, Ocean Instrumentation; E E 785, Underwater Acoustics; M E 737, Ocean Mechanics I; M E 738, Ocean Mechanics II; M E 751, Naval Architecture in Ocean Engineering; M E 752, Submersible Vehicle Systems Design; M E 757, Coastal Engineering and Processes; Tech 610, Introduction to Ocean Engineering; and Tech 697, Ocean Projects. Ordinarily, students must take ESci 501, Tech 697, and three additional courses from the above list, two of which must be engineering courses.

Students wishing to take the ocean engineering minor should indicate their interest to their department chairperson no later than the beginning of the junior year. They will be assigned to their departmental ocean minor adviser, who will assist in planning courses.

Materials Science Minor

The minor is open to all students of the University. It offers a broad introduction to materials science. The minor is administered by the Department of Mechanical Engineering. Students should contact the minor supervisor by mid-semester of their junior year.

The students must complete at least 20 credits consisting of five courses as follows; required courses M E 561 with M E 561L or CiE 622 with Lab; two courses from the group M E 760, M E 766, and Chem 545; additional courses from the group M E 730, 760, 761, 763, 766, 793D (three or more credits), 794D (three or more credits), ESci 512, 513, Chem 517, 518, 545.

Interested students may consult Frederick G. Hochgraf, Department of Mechanical Engineering.

Biomedical Systems and Instrumentation

The biomedical systems and instrumentation minor encompasses the application of engineering science and technology to the fields of medicine and biology. Biomedical engineers participate in the development of medical instrumentation, physiological sensors, prosthetic devices, orthopedic and surgical devices, biomaterials, patient safety, and in the applications of computers to medical problems. Biomedical engineers may continue their studies at the graduate level and find employment in health-related fields.

Engineering students electing this minor must select a minimum of 6 credits from the list of science electives. Additionally, 14 other credits must be selected, in consultation with the minor adviser, from the list below. Since many of these courses have prerequisites, students should begin the program during their sophomore year. Students must complete satisfactorily 20 semester hours. During the final semester, application should be made to the dean to have the biomedical systems and instrumentation minor shown on transcripts.

Engineering Electives: Any 700-level course in Electrical Engineering (with prior approval of the minor chairperson); 695 (E E, M E, CiE, ChE), Engineering Projects and Independent Study (with prior approval of minor chairperson); M E 703, Heat Transfer; M E 707, Analytical Fluid Dynamics; M E 726, Experimental Mechanics; M E 727, Advanced Mechanics of Solids; ChE 601, Fluid Mechanics and Unit Operations; ChE 602, Heat Transfer and Unit Operations; ChE 605, Mass Transfer and Stagewise Operations; ChE 752, Process Dynamics and Control; ChE 696, Independent Study.

Science Electives: Zool 507-508, Human Anatomy and Physiology (or Zool 518, 527); Zool 777, Introduction to Neurobiology; Zool 778, Comparative Neurophysiology; Chem 651-652, Organic Chemistry (prerequisite: Chem 404 or 405); Bchm 656, Physiological Chemistry and Nutrition; PhEd 606, Neurology; PhEd 620, Physiology of Exercise; PhEd 652, Kinesiology.

Students interested in a career in biomedical systems and instrumentation should consult early in their curriculum with the minor adviser, W. Thomas Miller.

Oceanography

The minor in oceanography, available to all students in the University, consists of 20 semester hours with grades of C (2.00) or better and no pass/fail courses. No more than eight major requirement credits may be used. Students may not elect minors in both ocean engineering and oceanography. All courses in the program shall be selected by students in consultation with the oceanography minor adviser, T.C. Loder in the Department of Earth Sciences.

Required courses include: 1) ESci 501, Introduction to Oceanography; 2) two of the following courses: ESci 752, Chemical Oceanography; ESci 758, Introduction to Physical Oceanography; ESci 759, Geological Oceanography; 3) any two of the following courses, or a suitable substitute approved by the minor adviser (it is advisable that at least one of the courses be in the biological sciences): Bot 525, 722, 723; ChE 695; CiE 695; E E 695; ESci 502; INER 611; M E 695, 737, 738, 751, 752, 757; Micr 707, 708; Polt 511; Tech 610, 697; Zool 560, 674, 715, 720, 772, 775.

Students are encouraged to declare their intention to enter the program before the end of the junior year. During the final term, students should apply to the dean to have the minor shown on the transcript.

Environmental Engineering Minor

The environmental engineering minor is intended primarily for students in engineering and physical sciences. Students contemplating such a minor should plan on a strong background in the sciences and mathematics (including differential equations).

The minor provides a comprehensive introduction to major areas of interest in environmental protection, namely air pollution and water pollution, through the three required courses. Further breadth in environmental engineering or depth in specific areas can be attained through the choice of appropriate elective courses.

Requirements for the minor include a total of at least 20 credits from the following: 1) three required courses: ChE 609, Fundamentals of Air Pollution and Its Control; CiE 643, Introduction to Environmental Pollution Control; ChE 772, Physiochemical Processes for Water and Air Quality Control, or CiE 644, Water and Wastewater Engineering; 2) a minimum of two elective courses from the following list: ChE 605, Mass Transfer and Stagewise Operations; ChE 606, Chemical Engineering Kinetics; ChE 772, Physiochemical Processes for Water and Air Quality Control; CiE 644, Water and Wastewater Engineering; CiE 740, Rural Wastewater Treatment; CiE 743, Environmental Sampling and Analysis; CiE 744, Environmental Limnology; CiE 746, Wastewater Treatment Plant Design; CiE 747, Introduction to Marine Pollution and Control; CiE 748, Solid Waste Disposal; CiE 749, Water Chemistry; ChE 604, Chemical Engineering Thermodynamics; Micr 501, Public Health Microbiology; 695, Engineering Projects (ChE, CiE, E E, M E).

Choice of elective courses should be made in consultation with the minor area adviser, Windsor Sung, CiE, or Stephen S. T. Fan, ChE. Students normally start this program in the junior year and should declare their intention to enter the program as early as possible during the sophomore year. Prior to the final term, students should apply to the dean to have the minor shown on the transcript.

Other Programs

Independent Study and Projects All departments within the college offer courses in independent study or in projects, the content varying with the current scientific and technological needs and with student and faculty interest.

Permission of the instructor and/or the department chairperson is required. (See the course descriptions for the independent study and project courses and for specific requirements.) The initiative for independent study courses in any area rests with the student.

Special Provisions "The requirement of a given course in any prescribed curriculum may be waived by the faculty of a student's college. The student's petition must be approved by his/her major adviser and the dean of the college. This power will usually be delegated by the faculty to the dean or to a committee." (Senate Rule 05.21(s): Waiver of Requirements in a Prescribed Curriculum)

This rule offers students the opportunity to develop a somewhat individualized plan of study with intellectual incentives and opportunities in addition to those in a regular curriculum.

In addition, upon the recommendation of the department chairperson, superior students may be allowed to count credits from up to two 800-level courses toward both a bachelor's degree and a master's degree, provided that the students have been admitted to the master's program.

Research Opportunities The talents and expertise of the faculty in all departments are reflected in the number of ongoing research projects. Undergraduates are included in many of these research projects, with the intent of discovering and fostering their creative talents. In funded research projects, students may have an opportunity to receive pay while learning.

Some flavor of the multiplicity of the research programs is reflected in special facilities, a few of which are: Analog Computer Facility, Antenna Systems Laboratory, Bioelectronics Laboratory, Computation Science Center, Electronics Laboratory, Engineering Design and Analysis Laboratory, Fluid Mechanics Laboratory, Materials Laboratories, Mechanics Research Laboratory, Sanitary Engineering Laboratory, Solid State Laboratory, Space Science Center, Wind Tunnel and Water Tunnel Facility, and X-ray Laboratory.

Students have the opportunity to acquire applied experience in business and industry by working with faculty members who undertake client-sponsored professional projects in management and technical areas for business and industry, and for state and local governments.

Preparing for Teaching Students interested in mathematics education (elementary or secondary), chemistry and physics teaching, or earth science teaching should refer to the Preparing for Teaching section that begins on page 22 and to the appropriate department description of the requirements.

Combined Programs of Study

In addition to pursuing a single major, students may combine programs of study as follows:

Minors: See page 17 for requirements. See also Interdisciplinary Minors, pages 23 and 50, and Departmental Programs of Study in this section.

Second Majors: See page 17.

Interdisciplinary Majors: Many of the departments in the college offer ways of combining a major with another field of interest. See the descriptions that follow.

Dual-Degree Programs: See page 16.

Student-Designed Majors: See page 80.

Other combined and interdisciplinary opportunities are described in "Special University Programs," pages 79–83.

Departmental Programs of Study

In addition to the following departmental majors and options, these departmental minors are offered:

Chemical engineering
Chemistry
Civil engineering
Electrical engineering
Engineering technology
Geology
Mathematics
Mechanical engineering
Physics

Chemical Engineering

(For descriptions of courses, see page 109.)

Chemical engineering is concerned with the analysis and design of processes that deal with the transfer and transformation of energy and material.

The practice of chemical engineering includes the conception, development, design, and application of physicochemical processes and their products; the economic development, design, construction, operation, control, and management of plants for these processes; and activities relating to public service, education, and research.

Traditional employment areas in the chemical process industries include industrial chemicals, petroleum and petrochemicals, plastics, pharmaceuticals, metals, textiles, and food. Chemical engineers are also working in increasing numbers in the emerging areas of energy engineering, pollution abatement, and biochemical and biomedical engineering; in addition, they are employed by many of the government laboratories and agencies as well as private industries and institutions.

The curriculum is designed to provide training for students to enter the diverse areas of employment or graduate study. The considerable number of electives in the curriculum provides flexibility for individuals to design programs that fulfill their needs and interests. They also provide an opportunity for students to elect departmental options or interdisciplinary minors in their programs.

A minimum of 129 credits is required for graduation with the degree of Bachelor of Science in Chemical Engineering. There are 11 electives in the chemical engineering curriculum. Six of these are for the arts, humanities, and social science requirements, and one must be chosen from the biological sciences. The remaining four electives should consist of two chemical engineering electives, one technical elective, and one free elective.

Students are required to obtain a minimum of 2.00 grade-point average in Chemical Engineering 501-502 and in overall standing at the end of the sophomore year in order to continue in the major.

Freshman Year		Fall	Spring
Engl 401	Freshman English	4	—
Math 425-426	Calculus I and II	4	4
Phys 407-408	General Physics I and II	4	4
Chem 405	Introductory Chemistry	4	—
ChE 410	Survey of Current Energy and Pollution Control Technology	—	4
Elective		—	4
		16	16
Sophomore Year			
Chem 683-684	Physical Chemistry I and II	3	3
Chem 685-686	Physical Chemistry Laboratory	2	2
Math 527	Differential Equations with Linear Algebra	4	—
C S 403	Introduction to Digital Computer Programming	2	—
ChE 501-502	Introduction to Chemical Engineering I and II	3	3
Electives (3)		4	8
		18	16
Junior Year			
Chem 547-548	Organic Chemistry	3	3
Chem 549	Organic Chemistry Laboratory	2	—
ChE 601	Fluid Mechanics and Unit Operations	3	—
ChE 602	Heat Transfer and Unit Operations	—	3
ChE 603	Applied Mathematics for Chemical Engineers	4	—
ChE 604	Chemical Engineering Thermodynamics	—	4
ChE 612	Chemical Engineering Laboratory I	—	2
Electives (2)		4	4
		16	16
Senior Year			
ChE 605	Mass Transfer and Stagewise Operations	3	—
ChE 606	Chemical Engineering Kinetics	3	—
ChE 608	Chemical Engineering Design	—	3
ChE 613	Chemical Engineering Laboratory II	2	—
Electives (5)		8	12
		16	15

Energy Option This option covers the major areas of current interest in the energy field. The required courses provide students with a general background knowledge of fossil fuels, nuclear power, solar energy, and other alternative energy resources. The elective courses will permit the student to study topics of special interest in more depth or gain a broader perspective on energy and some closely related subjects. Three courses are required, and a minimum of two additional courses of at least three credits each should be selected from the electives list. Students interested in the energy option should declare their intention during the sophomore year to the department faculty. They may consult with Stephen S. T. Fan.

Required Courses		
ChE 705	Natural and Synthetic Fossil Fuels	4
ChE 712	Introduction to Nuclear Engineering	4
M E 710	Solar Heating Systems	3
		11

Elective Courses		
ChE 695	Chemical Engineering Project	3-4
ChE 696	Independent Study	3-4
ChE 772	Physicochemical Processes for Air and Water Quality Control	4
M E 504	Thermodynamics II	4
		6-8

Environmental Engineering Option The chemical engineering program, with its substantial requirement in chemistry, fluid dynamics, heat transfer, mass transfer, unit operations, and reaction kinetics, provides students with a unique preparation to deal with many aspects of environmental pollution problems. The option gives students a special focus on the application of chemical engineering principles and processes to the solution of problems relating to air pollution, water pollution, and the disposal of solid waste. Three required courses must be selected, plus two electives from the electives list. Each course must carry a minimum of three credits. Students interested in the environmental engineering option should declare their intention during the sophomore year to the department faculty. They may consult with Stephen S. T. Fan.

Required Courses		
ChE 609	Fundamentals of Air Pollution and Its Control	4
ChE 772	Physicochemical Processes for Water and Air Quality Control	4
CiE 748	Solid Waste Disposal	3
		11

Elective Courses		
ChE 695	Chemical Engineering Project	3-4
ChE 696	Independent Study	3-4
CiE 746	Wastewater Treatment Plant Design	3
CiE 749	Chemistry of Natural Waters	3
		6-8

Chemistry

(For descriptions of courses, see page 110.)

Students interested in chemistry may major in one of four programs offered in the department, depending upon their plans for a career. Since the required chemistry courses in each degree program are the same in the first year, it is easy to change from one program to another, or even to another major.

In each of the programs, students should register for the following courses in the first year: Chem 405 (first semester), Introductory Chemistry; Chem 406 (second semester), Quantitative Analysis; Math 425 (first semester), Calculus I; and Math 426 (second semester), Calculus II. Students interested in a chemistry program may consult with the coordinator of undergraduate studies in the department.

Bachelor of Science in Chemistry

This curriculum is intended to prepare students for careers as professional chemists and to provide a strong foundation for graduate study in chemistry or in interdisciplinary areas of science calling for a strong background in chemistry. The curriculum requires a greater depth in chemistry and physics than do the other degree programs.

Requirements

1. Satisfy General Education Requirements.
2. Language requirement: Much of the chemical literature is in German or Russian and has not been translated. Students must demonstrate a proficiency in one of these languages by completing a year's course in that language. The choice is up to the individual.
3. For specific course requirements, see the accompanying chart.

Bachelor of Arts, Chemistry Major

This curriculum offers students the opportunity to combine a chemistry major with other interests. There are fewer required courses in chemistry and physics, and students have more opportunity to elect courses in other areas according to individual interests. The pre-healing arts students interested in chemistry, those preparing for secondary school teaching, or those interested in business can combine these interests with chemistry in this curriculum.

Requirements

1. Satisfy General Education Requirements.
2. Satisfy the Bachelor of Arts degree requirements (see page 16).
3. For specific course requirements, see the accompanying chart.

Chemistry Baccalaureate Degree Requirements

Chemistry Courses	B.S.	B.A., Chemistry Major	B.A., Science Major
405*	x	x	x
406 & 407, or 517 & 518	x	x	x
547 & 549, or 651 & 653	x	x	
548 & 550, or 652 & 654	x	x	
683 & 685	x	x	
684 & 686	x	x	
762 & 763	x	x	
697	x	two other chemistry courses chosen from these, except 697 and 698, or two approved chemistry-related courses	four other chemistry courses chosen from these, except 697 and 698
698	x		
699	x		
755 & 756	x		
774 & 775	x		
776	x		
663			
708			
778			

Other Requirements
All majors: Math 425 and 426, Calculus I and II.

B.S. degree: Phys 407-408, General Physics I and II; Germ 401-402 or 403-404, or Russ 401-402; C S 403 or 410, Introduction to Computer Programming; two chemistry-related courses (only one of which may be a chemistry course).†

B.A. degree, chemistry major: Phys 407, General Physics I, or Phys 401-402, Introduction to Physics I and II

B.A. degree, science major: three approved courses in mathematics or science to complete major requirement; and two other science or mathematics courses to complete University science requirement).†

*Chem 403-404 may be substituted for Chem 405, but this is not recommended.
†Suggested courses: Math 527 or 528; Phys 505; E E 620; Bchm 601.

Bachelor of Arts, Science Major, Chemistry Concentration

This curriculum is for students interested in chemistry but wishing a broader exposure to other disciplines than can be obtained in a chemistry major. Students interested in interdisciplinary science or in chemistry as a cultural subject can satisfy their interests in this degree program, which is not intended to prepare professional chemists but, rather, is the basis for a broad liberal education.

Requirements
1. Satisfy General Education Requirements.
2. Satisfy the Bachelor of Arts degree requirements (see page 16).
3. For specific course requirements, see the accompanying chart.

Bachelor of Arts, Chemistry and Physics Teaching

This major is designed for students who wish to teach chemistry and physics in secondary schools. The number of positions available for teaching only chemistry or physics is limited, and there are more opportunities to teach both subjects on the secondary-school level. Chemistry and physics teaching majors will have good preparation for teaching these subjects and will have the necessary mathematics and education background.

Requirements
1. Satisfy General Education Requirements.
2. Satisfy the Bachelor of Arts degree requirements (see page 16).
3. Chemistry requirements: 405, Introductory Chemistry or 403-404, General Chemistry; 406, 407, Quantitative Analysis; 545, 546 or 547-548 and 549-550, Organic Chemistry; 683-684 and 685-686, Physical Chemistry I and II.
4. Physics requirements: 407, General Physics I; 408, General Physics II; 505, General Physics III; 605, Experimental Physics I; and Physics 406, Introduction to Modern Astronomy, strongly recommended.
5. Math requirements: 425, Calculus I, and 426, Calculus II.
6. All education courses in the teacher preparation program (see pages 22–23).

Civil Engineering

(For descriptions of courses, see page 112.)

Civil engineers are concerned with planning, design, and construction of public and private facilities, which must not only provide safe, efficient service to the users but must, in addition, be compatible with the environment (both natural and human) in which they are placed.

The program leads to a Bachelor of Science degree in civil engineering. The strong analytical basis of the program prepares graduates for many career opportunities. They may enter professional practice or pursue further study in graduate school. Undergraduates study the basic sciences and mathematics, as well as engineering science, analysis, and design.

Freshman Year		Fall	Spring
CiE 400	CiE Lectures	0	—
CiE 505	Surveying	—	4
Math 425, 426	Calculus I, II	4	4
Chem 403, 404	General Chemistry I, II	4	4
Engl 401	Freshman English	4	—
Phys 407	General Physics I	—	4
Elective (1)	Group II	4	—
		16	16
Sophomore Year			
CiE 525, 526	Mechanics I, II	3	3
CiE 527	Mechanics III	—	3
Phys 408	General Physics II	4	—
Math 527	Differential Equations	4	—
Math 528, 644, or 645		—	4
C S 410	Computer Programming	4	—
C S 503	Applied Computer Techniques	—	3
Electives (2)	Group II	4	4
		19	17
Junior Year			
CiE 622	Engineering Materials	4	—
CiE 642	Fluid Mechanics	4	—
CiE 643	Introduction to Environmental Pollution Control	3	—
CiE 681	Structural Analysis	3	—
CiE 644	Water and Wastewater Engineering	—	3
CiE 665	Soil Mechanics	—	4
CiE Elective (1)*		—	3
Electives (2)	Group II	4	4
Elective (1)	Any department except CiE (Recommend EE 541, ME 503, or ChE 604)	—	4
		18	18
Senior Year			
CiE 682	Project Planning and Design	—	4
CiE 733	Systems Analysis	3	—
Elective (1)	Group I (Biological Science)	4	—
CiE Electives (5)*		9	6
Elective (1)	Group II	—	4
		16	14

*Minimum of two approved design courses is required, one of which must be CiE 793 or 794.

The electives will be chosen to meet requirements of the University, the department, and any option selected.

To enter required 600-level CiE courses, a CiE major must have a 2.00 cumulative grade-point average and must have completed the CiE 525, 526, 527 sequence with a 2.00 grade-point average. Exceptions to these requirements will be granted only under extremely unusual circumstances and will require approval of a petition by the student's adviser and department chairperson.

A minimum of 133 total credits is required for graduation. To qualify for graduation, the student must have a 2.00 average in all CiE courses.

Environmental Engineering Option Environmental engineering is the application of engineering principles and practices to one or more elements of the environment to protect or improve the quality of life. Environmental engineers use specialized engineering knowledge to manage water, air, and land resources systematically. This option provides fundamental environmental engineering concepts and methods of design and allows specialization in an area of the student's choice.

Four courses (14 credits) are required. At least 8 additional credits must be selected from the following list of elective courses, of which a minimum of 4 credits must be in civil engineering. Courses not on the list may be elected upon approval of the student's adviser.

The option is selected at the beginning of second semester in the junior year and the student must meet all the previously listed graduation requirements. Interested students may consult with the option adviser, Paul L. Bishop.

Required Courses		
Micr 503	General Microbiology	5
CiE 743	Environmental Sampling and Analysis	3
CiE 746	Wastewater Treatment Plant Design	3
CiE 749	Water Chemistry	3
		14

Elective Courses		
CiE 734	Systems Analysis II	3
CiE 740	Rural Wastewater Engineering	3
CiE 741	Open Channel Flow	3
CiE 744	Environmental Limnology	4
CiE 745	Hydrology and Hydraulics	3
CiE 747	Introduction to Marine Pollution Control	3
CiE 748	Solid Waste Disposal	3
CiE 794	Reinforced Concrete Design	4
Chem 545	Organic Chemistry (plus laboratory)	5
Chem 683	Physical Chemistry I	3
ChE 609	Fundamentals of Air Pollution and Its Control	4
Hydr 710	Groundwater Hydrology	4

Constructed Systems Option All structures, regardless of purpose, must be planned, designed, and built to resist the natural forces (gravity, wind, earthquake) and those imposed by people during construction and use of the structure.

Two courses (8 credits) are required. A minimum of 5 additional courses (15 credits) must be elected from the following list, of which 4 courses (11 credits) must be in civil engineering. Courses not on the list may be elected upon approval of the student's adviser.

The option is selected at the beginning of second semester in the junior year and must meet all the previously listed graduation requirements. Interested students may consult with the option adviser, Louis H. Klotz.

Required Courses (2)		
CiE 685	Indeterminate Structures	4
CiE 793 or 794	Structural Design in Steel or Reinforced Concrete Design	4

Electives (5)		
Minimum of 11 credits from the following:		
CiE 763	Advanced Soil Mechanics I	3
CiE 765	Foundation Engineering	3
CiE 766	Geological Engineering	3
CiE 782	Timber Design	2
CiE 784	Structural Analysis by Matrix and Numerical Method	3
CiE 785	Introduction to Structural Vibrations	3
CiE 786	Finite Element Applications for Solid Mechanics	3
CiE 791	Prestressed Concrete	3
CiE 793 or 794	Structural Design in Steel or Reinforced Concrete Design	4
Minimum of 4 credits from the following:		
Arts 455	Introduction to Architecture	4
ESci 401 or 402	Principles of Geology I or II	4
Math or C S	(any 600 course or above)	4
M E 441	Engineering Graphics	4
M E 727	Advanced Mechanics of Solids	4
Hydr 603	Hydrology and Water Management	4

Computer Science

(For descriptions of courses, see page 116.)

Computer scientists are concerned with all aspects of the design, implementation, and application of computers. They are concerned with problem solving in general, with particular emphasis on the design of computer-efficient solutions. This involves detailed understanding of the nature of algorithms, the software implementation techniques necessary to utilize these algorithms on computers, and a knowledge of how algorithms can be combined in a structured manner to form highly complex software systems.

The program leads to a B.S. in Computer Science and is designed to prepare students for employment in the computer field or to pursue graduate study in computer science. The program emphasizes the application of computer science theory and principles but also includes a broad background in

basic mathematics and an introduction to computer hardware. Most courses require heavy use of the computer, and the laboratories stress hands-on experience with computer equipment.

Demand for the B.S. in Computer Science far exceeds the department's resources. Therefore, enrollment in the B.S. in Computer Science program is limited. Transfer into this program is on a space-available basis only and cannot be guaranteed. Selection is based on overall grade-point average and achievement in computer science courses.

Computer science students must obtain a grade of C− or better and an overall grade-point average of 2.00 or better in all computer science courses as a requirement for graduation.

Requirements

1. Sixteen full credit courses chosen from specified groups as required by the University.

Group I: 4 courses chosen from an approved list of biological and physical science courses, excluding all mathematics or computer science courses.

Group II: 6 courses chosen from an approved list of social science, arts, and humanities courses. Phil 550 (Symbolic Logic) is strongly recommended.

Group III: 6 courses, three of which must be Engl 401, E E 531 (Elements of Digital Logic), and E E 612 (Logical Design of Digital Computers), chosen from all courses offered by the University, excluding all mathematics courses used for major credit, and all computer science courses.

2. Fifteen full credit courses chosen as follows:

Six required computer science courses: C S 410, (all modules)—Introduction to Computer Programming; C S 610, Operating System Fundamentals; C S 611, Assembler Language Programming; C S 612, Data Structures and Processes; C S 711, Programming Languages and Compilers; and C S 753, Numerical Methods and Computers I.

Five required mathematics courses: Math 425, Calculus I; Math 426, Calculus II; Math 531, Mathematical Proof (Sec. C, Discrete Computational Mathematics); Math 644, Applied Probability and Statistics (or 735/6); and Math 645, Applied Linear Algebra (or 761/2).

Four approved computer science electives chosen from the following groups:

a. C S courses numbered 696 or above.
b. E E 711 or E E 714.

3. One 2-credit elective.

Earth Sciences

(For descriptions of courses, see page 120.)

The courses offered in the Department of Earth Sciences cover the broad spectrum of geology and oceanography. They encompass a group of related studies concerned with an understanding of the size, shape, and constitution of the earth; the processes that are now, or have formerly been, at work upon its surface, in its oceans, and within its interior; its origin; and evolution of life upon it.

The need for people trained in the earth sciences has been emphasized by the search for new and additional energy sources and essential mineral resources, by the increased concern with intelligent management of the environment, and by expansion of research in both oceanography and extraterrestrial geology. In addition, the demand for well-trained secondary teachers of earth sciences has steadily increased over the past few years.

Four undergraduate degree programs are offered through the Department of Earth Sciences. Students interested in an earth sciences program may consult with the department chairperson, Herbert Tischler.

Bachelor of Science in Geology

This program represents the strongest concentration in the earth and cognate sciences and is especially well suited for students who plan to continue their studies in graduate school. Beyond a central core of courses, there is sufficient flexibility in course selection so that students may, in consultation with their academic advisers, orient the program toward a particular facet of the earth sciences (e.g., mineralogy-petrology, oceanography, geomorphology, paleontology-stratigraphy, etc.).

Requirements

1. Satisfy the General Education Requirements.

2. Satisfactorily complete Math 425 and 426, Chem 403-404, and Phys 407-408 and 505.

3. Complete a minimum of 12 courses in earth sciences, which should include: ESci 401, Principles of Geology I or ESci 409, Environmental Geology; ESci 402, Principles of Geology II; ESci 501, Introduction to Oceanography; ESci 502, Oceanography Lab; ESci 512-513, Mineralogy; ESci 531, Structural Geology; ESci 561, Geomorphology; ESci 614, Petrography; ESci 652, Biostratigraphy; and three approved earth sciences electives.

4. Complete four approved electives. The following courses should be considered: Math 527-528; Chem 683-684; C S 410; Zool 412; Bot 411; and statistics.

Bachelor of Arts, Geology Major

This program offers students an opportunity to obtain a broad liberal education and a general background in geology with a greater degree of freedom in choosing electives than in the Bachelor of Science program. By a careful choice of electives, students can prepare for graduate school, business, or industry.

Requirements

1. Satisfy the General Education Requirements.

2. Satisfy the Bachelor of Arts degree requirements (page 16).

3. Complete a minimum of eight courses in the department with a C− (1.67) or better, which should include: ESci 401, Principles of Geology I or ESci 409, Environmental Geology; ESci 402, Principles of Geology II; ESci 512, Principles of Mineralogy; and five upper-level earth sciences courses, two of which must be chosen from courses numbered 700 or above.

4. Math requirements: 425, Calculus I, and 426, Calculus II.

It is strongly advised that students complete, as early as possible, a year each of college chemistry and physics.

It is also suggested that students include Hist 521-522, History of Science, in their program.

Bachelor of Arts, Science Major, Earth Sciences Concentration

This program is for the student who wants a liberal education with a scientific slant to it. It is not designed to produce professional scientists but rather combines the liberal arts with a reasonable exposure to science in general and to earth sciences in particular.

Requirements

1. Satisfy the General Education Requirements.
2. Satisfy the Bachelor of Arts degree requirements (page 16).
3. Complete: ESci 401, Principles of Geology I or ESci 409, Environmental Geology; ESci 402, Principles of Geology II; ESci 501, Introduction to Oceanography; and three approved earth sciences electives.
4. Math requirements: 425, Calculus I, and 426, Calculus II.
5. Additional major requirements: three approved courses in science over and above those used to satisfy University General Education Requirements.

Bachelor of Arts, Earth Science Teaching Major

This program is specifically designed to prepare students to teach earth sciences in secondary school. Upon graduation from this program, students receive a full teacher certification which is recognized in most states.

Requirements

1. Satisfy the General Education Requirements.
2. Satisfy the Bachelor of Arts degree requirements (page 16).
3. Complete: ESci 401, Principles of Geology I or ESci 409, Environmental Geology; ESci 402, Principles of Geology II; ESci 501-502, Introduction to Oceanography; Geog 473, The Weather; Chem 403-404, General Chemistry; Phys 401-402, Introduction to Physics I and II; Phys 406, Introduction to Modern Astronomy; plus 12 approved elective credits from intermediate and/or advanced earth sciences courses.
4. Math requirements: 425, Calculus I, and 426, Calculus II.
5. Satisfy the secondary-school teacher education program. (See "Preparing for Teaching," pages 22–23.)

Electrical and Computer Engineering

(For descriptions of courses, see page 126.)

Electrical and computer engineers are designing systems for investigating the ocean, for monitoring medical procedures, and for processing information from outer space. They develop electronic instrumentation for environmental protection, design mini- and microcomputers for industry, and use their knowledge to help solve such major problems of society as transportation, pollution, and health care delivery.

At UNH, the keynote of the electrical and computer engineering program is the involvement of students in the solution of real-world problems. During the freshman and sophomore years, students take basic courses in mathematics and physics, learn how to use the computer, and receive introductory experience in electric circuits, logic design, and electronics.

The electrical and computer engineering curriculum prepares students for graduate work in electrical engineering, for productive employment as electrical engineers, and for graduate work in related areas such as business administration. It is compatible with the dual-degree program described on page 16.

Electrical engineering students must obtain a 2.00 grade-point average in E E courses as a requirement for graduation.

In order for an electrical and computer engineering major to enter the junior year and take any of the following first-term junior courses: E E 517, E E 545, E E 551, E E 603, or E E 612, he or she must have a 2.10 grade-point average in the following freshman and sophomore courses: Math 425, 426, 527; Physics 407, 408, 505; and E E 541, 543, 544, and 548. A student who has not met this requirement has three choices of action: 1) petition to the department's Undergraduate Committee for a waiver of the requirement based on extenuating circumstances; 2) a change of major; or 3) repeat certain of the ten freshman or sophomore courses until the grade-point average in the ten courses reaches 2.10.

If any electrical and computer engineering student achieves a cumulative grade-point average in ECE courses which is less than 2.00 during any three semesters, the department will recommend to the dean of the College of Engineering and Physical Sciences that the student be suspended for lack of progress toward his or her degree.

Basic Curriculum for Bachelor of Science in Electrical Engineering

Students, with their advisers' assistance, should plan their programs based on the following distribution of courses for a total of 133 credits. Students who have not had a year of high school chemistry with a grade of B or better are required to take Chem 403 sometime during their college program. For those students, 137 credits are required for graduation.

First Two Years Are Common to All Options

Freshman Year		Fall	Spring
Core Courses			
Math 425 and 426	Calculus I and II	4	4
Engl 401	Freshman English	—	4
Elective	Life science elective	4	—
C S 410	Introduction to Computer Programming	—	4
Phys 407, 408	General Physics I and II	4	4

Electives (1)	Group II	4	—
		16	16
Sophomore Year			
Core Courses			
Math 527	Differential Equations with Linear Algebra	4	—
E E 544	Signal Processing Fundamentals	—	3
Phys 505	General Physics III	—	4
E E 541	Electrical Circuits	4	—
E E 543	Introduction to Digital Systems	4	—
E E 548	Circuits and Electronics	—	4
M E 523	Introduction to Statics and Dynamics	—	3
Electives (2)	Group II	4	4
		16	18
Junior Year			
Core Courses			
E E 545	Electrical Networks	3	—
E E 551	Advanced Electronics I	3	—
E E 546	Probability and Discrete Systems	—	3
E E 603	Electromagnetic Fields and Waves I	3	—
E E 517-518	Junior Laboratory I and II	1	3
E E 656	Electromechanical Devices	—	3
Electives (2)	Group II	4	4
E E 612	Logical Design of Digital Computers	4	—
	Subtotal	18	13
Computer Engineering Option			
C S 610	Operating System Fundamentals	—	4
	Total	18	17
Electrical Engineering Systems Option			
E E 552	Advanced Electronics II	—	4
	Total	18	17
Senior Year			
Core Courses			
Elective (1)	Group II	4	—
M E 505	Introduction to Thermodynamics and Heat Transfer	—	4
Electives (2)	Group III elective	4	—
	Free elective	—	4
	Subtotal	8	8
Computer Engineering Option			
E E 714	Minicomputer Applications Engineering	—	4
E E 711	Digital Systems	4	—
E E 757 or 782	Communication or Control Systems	4	or 4
Electives	Approved professional elective	4	or 4
	Total	16	16
Electrical Engineering Systems Option			
E E 757	Fundamentals of Communications	4	—
E E 782	Control Systems	—	4
Electives	Approved professional electives	4	4
	Total	16	16

Options and Minors

In the junior year, students complete the core courses and begin studying in a chosen option. Students must choose one of the three options and additionally may elect one of the various minors (see pages 50–52 for descriptions of minors). The options, which are described in the following paragraphs, provide for professional electives so that individual student interests may be pursued. In addition, the senior year features many opportunities for individual or group projects. Each option is made up of five courses.

Computer Engineering Option During the past several years, advances in the technology of electronic circuit manufacture have vastly reduced the costs of digital computers. This low cost, coupled with flexibility, has allowed them to be used in a broad variety of applications, from data processing in a small retail store to controlling a machine tool in a manufacturing plant. Since computers are basically electronic devices, it is primarily the job of electrical engineers to design or specify the purchase of the computer and integrate it into larger systems. To do so requires a knowledge of both hardware (circuits) and software (programming) concepts. In this option, students will learn to design, build, and test systems involving digital computers.

Required Courses: E E 711, E E 714, C S 610.

Elective Courses: E E 757 or E E 782; and one approved professional elective chosen in consultation with the adviser to meet students' professional objectives.

Electrical Engineering Systems Option The electrical engineering systems option provides students with the fundamentals of communication, control, and computer systems. An effort is made to balance both the theory and the applications so that students will appreciate both system development and system implementation. In addition to the four required courses, there are three additional professional elective courses that allow students to delve further into areas of interest.

Required Courses: E E 552, E E 757, and E E 782.

Elective Courses: Two courses chosen in consultation with the adviser to satisfy students' and programmatic goals.

Student-Designed Option This option is for the unusual student whose grade-point average is at least 2.70 and who has well-defined academic goals that cannot be satisfied by either of the regular options. The student and adviser will prepare an option proposal which will include a statement of the student's goals and a listing of the option courses that will be taken. Each student's proposal will require approval by the department's Undergraduate Committee.

Engineering Technology

(For descriptions of courses, see page 129.)

Engineering technology is the part of the engineering field that requires the application of engineering and scientific knowledge and methods combined with technical skills in support of engineering activities. Normally engineering technology is not concerned with the development of new principles and methods. The Engineering Technology Program offers only junior- and senior-level work. Students admitted to this program must have an appropriate associate degree from the New Hampshire Technical Institute, the Vermont Technical College, or an equivalent school.

Curricula in electrical engineering technology and mechanical engineering technology are offered. Students may continue study in their fields of specialization, select electives which broaden their educational backgrounds, and participate in project courses where, as part of a technology team, their talents are applied in solving real problems.

Students interested in an engineering technology program may consult with the program director, T. Antero Parssinen.

Electrical Engineering Technology

Junior Year		Fall	Spring
E T 671	Digital Systems	—	4
E T 677	Analog Systems	4	—
E T 637	Heat and Fluid Power I	4	—
E T 674	Control Systems and Components	4	—
E T 680	Communications and Fields	—	4
C S 410	Introduction to Computer Programming	—	4
E T 695 A	Engineering Technology Analysis	2	—
Electives (2)		4	4
		18	16
Senior Year			
E T 691	Electrical Engineering Technology Project	4	4
E T 633	Industrial Organization and Law	4	—
E T 634	Economics of Business Activities	—	4
E T 690	Microcomputer Technology	4	—
Electives (3)		4	8
		16	16

Mechanical Engineering Technology

Junior Year		Fall	Spring
E T 637 and 638	Heat and Fluid Power I and II	4	4
E T 641	Production Systems	4	—
E T 675	Electrical Technology	4	—
E T 644	MET Concepts in Design and Analysis	—	4
Electives (2)		4	4
C S 410	Introduction to Computer Programming	—	4
E T 695 A	Engineering Technology Analysis	2	—
		18	16
Senior Year			
E T 651	Mechanical Engineering Technology Project	4	4
E T 633	Industrial Organization and Law	4	—
E T 634	Economics of Business Activities	—	4
E T 645	Instrumentation	4	—
Electives (3)		4	8
		16	16

Mathematics

(For descriptions of courses, see page 152.)

Six undergraduate programs are offered through the Department of Mathematics. Normally, students will enter one of these specific programs; however, generally, they may change programs within the department at any time. Enrollment in the interdisciplinary B.S. electrical science or computer science options is limited, and transfer into these programs cannot be guaranteed. Students who take C S 410 and Math 425 and 426 in the freshman year are on schedule in any of the six programs in the department.

In the sophomore year, Math 527, 528 and 531 will keep a student on schedule in either of the B.A. programs. In three of the four B.S. programs, these three courses plus one other (depending on the program) constitute the recommended sophomore sequence. The B.S. in mathematics-education (elementary option) has a completely different sophomore sequence. Thus, a student can maintain reasonable flexibility for program change within the department for two years.

In some programs, there are courses outside the department that should be completed in the sophomore year. These are noted in the detailed lists of requirements that follow.

Computer science courses play a special role in mathematics major programs. No C S course may be used by a mathematics major to satisfy Group I General Education Requirements. C S 410 is required in all mathematics programs and may be used in Group III. Some math electives may be replaced by C S electives (see specific program requirements below), and C S courses used in this way may not be used to satisfy General Education Requirements. Other C S courses may be used in Group III.

Bachelor of Science in Mathematics

This program represents the strongest concentration in mathematics of any program offered by the department. Included among the required courses are those usually required for admission to graduate work in mathematics. Through a judicious choice of electives, students may construct a stronger pregraduate program, or they may slant the program toward a career in business or industry.

Requirements

1. Sixteen full credit courses chosen from specified groups as required by the University.

Group I: Four courses chosen from an approved list of biological and physical science courses, excluding all courses in mathematics and computer science. Physics 407 and 408 are required.

Group II: Six courses chosen from an approved list of social science, arts, and humanities courses.

Group III: Six courses, two of which must be English 401 and C S 410, chosen from all courses offered by the University, excluding all mathematics courses. French, German, or Russian 401 and 402 are required.

2. Thirteen full credit courses in mathematics chosen as follows—

Eleven required courses: Math 425, Calculus I; Math 426, Calculus II; Math 527, Differential Equations; Math 528, Multidimensional Calculus; Math 531, Mathematical Proof; Math 644, Applied Probability and Statistics (or 735-736); Math 761, Abstract Algebra; Math 762, Linear Algebra; Math 767, One-Dimensional Real Analysis; Math 784, Topology; and Math 788, Complex Analysis.

One approved mathematics elective chosen from (a) below, and one approved mathematics and/or computer science elective chosen from either (a) or (b):

a) Mathematics courses numbered 646 or above, excluding 698, 703, and 791.
b) Computer science courses numbered 610 or above.

3. Three free electives.

Bachelor of Arts, Mathematics Major

This program offers a broader liberal education than do any of the Bachelor of Science programs. By a careful choice of electives, however, students can shape this major into a preparation for graduate school, business, or industry.

Requirements

1. Sixteen full credit courses chosen from specified groups as required by the University.

Group I: Four courses chosen from an approved list of biological and physical science courses, excluding all courses in mathematics or computer science.

Group II: Six courses chosen from an approved list of social science, arts, and humanities courses.

Group III: Six courses, four of which must be English 401, foreign language 401 and 402, and C S 410, chosen from all courses offered by the University, excluding all mathematics courses.

2. Eleven full credit courses in mathematics and/or computer science chosen as follows—

Nine required courses: Math 425, Calculus I; Math 426, Calculus II; Math 527, Differential Equations; Math 528, Multidimensional Calculus; Math 531, Mathematical Proof; Math 644, Applied Probability and Statistics (or 735-736); Math 761, Abstract Algebra; Math 762, Linear Algebra; and Math 767, One-Dimensional Real Analysis.

Two approved mathematics and/or computer science electives chosen from mathematics courses numbered 646 or above, excluding 698, 703, and 791 and computer science courses numbered 610 or above.

3. Five free electives.

Bachelor of Arts, Science Major, Mathematics Concentration

This program is for students who want a liberal education with a scientific slant to it. It is not designed to produce professional scientists but, rather, combines the liberal arts with a reasonable exposure to science in general and mathematics in particular.

Requirements

1. Sixteen full credit courses chosen from specified groups as required by the University.

Group I: Four courses chosen from an approved list of biological and physical science courses, excluding all courses in mathematics or computer science.

Group II: Six courses chosen from an approved list of social science, arts, and humanities courses.

Group III: Six courses, four of which must be English 401, foreign language 401 and 402, and C S 410, chosen from all courses offered by the University, excluding all mathematics courses.

2. Ten full credit courses in science chosen as follows—

Five required mathematics courses: Math 425, Calculus I; Math 426, Calculus II; Math 527, Differential Equations; Math 528, Multidimensional Calculus; and Math 531, Mathematical Proof.

One approved mathematics elective chosen from group (a) below, and one approved mathematics and/or computer science elective chosen from group (b) below.

a) Math 761, Abstract Algebra; Math 767, One-Dimensional Real Analysis.
b) Mathematics courses numbered 646 or above, excluding 698, 703, and 791, or computer science courses numbered 610 or above.

Three approved science courses over and above those used to satisfy General Education Requirements.

3. Six free electives.

Bachelor of Science in Mathematics Education

This is a professional degree program to prepare students for mathematics teaching at the elementary or secondary level. The program is coordinated with the education department's teacher certification programs. Students may complete the degree requirements with full teacher certification in either four or five years. Students electing the four-year option must plan for one semester of student teaching (Educ 694) in their senior year, and should consult with the mathematics department program adviser concerning the schedule of mathematics courses. The five-year program involves a required year-long teaching internship in the fifth year. (The internship can be coupled with other graduate work leading to a master's degree.) See "Preparing for Teaching," page 22.

Elementary Option

Requirements

1. Sixteen full credit courses chosen from specified groups as required by the University.

Group I: Four courses chosen from an approved list of biological and physical science courses, excluding all courses in mathematics and computer science. Physics 406 is required.

Group II: Six courses chosen from an approved list of social science, arts, and humanities courses.

Group III: Engl 401, Educ 500, Educ 700, Educ 701, Educ 705, and Educ 706.

2. Fourteen full credit courses in mathematics, mathematics education and computer science chosen as follows—

Thirteen required courses: C S 410, Introduction to Computer Programming; Math 419, Evolution of Mathematics; Math 425, Calculus I; Math 426, Calculus II; Math 531, Mathematical Proof; Math 621, Number Systems for Elementary School Teachers; Math 622, Geometry for Elementary School Teachers; Math 623, Topics for Elementary School Teachers; Math 636, Introductory Applied Statistics; Math 645, Applied Linear Algebra; Math 657, Geometry I; Math 703, Mathematics Education, K–6; and Math 791, Mathematics Education.

One additional approved mathematics or computer science elective, usually taken from: Math 656, Introduction to Number Theory; Math 658, Geometry II; Math 698, Senior Seminar; C S 610, Operating System Fundamentals; C S 611, Assembler-Language Programming; and C S 612, Data Structures and Processes.

3. Two free electives.

Secondary Option

Requirements

1. Sixteen full credit courses chosen from specified groups as required by the University.

Group I: Four courses chosen from an approved list of biological and physical science courses, excluding all courses in mathematics or computer science.

Group II: Six courses chosen from an approved list of social science, arts, and humanities courses.

Group III: Six courses, five of which must be Engl 401, Educ 500, Educ 700, Educ 701, and Educ 705, plus one elective chosen from courses offered by the University, excluding mathematics courses.

2. Fourteen full credit courses in mathematics, mathematics education, and computer science chosen as follows—

Twelve required courses: C S 410, Introduction to Computer Programming; Math 425, Calculus I; Math 426, Calculus II; Math 527, Differential Equations; Math 528, Multidimensional Calculus; Math 531, Mathematical Proof; Math 636, Introductory Applied Statistics (or 644 or 735-736); Math 645, Applied Linear Algebra (or 762); Math 657, Geometry I; Math 698, Senior Seminar; Math 761, Abstract Algebra; and Math 791, Mathematics Education.

Two additional approved mathematics or computer science electives, usually taken from: Math 656, Introduction to Number Theory; Math 658, Geometry II; Math 767, One-Dimensional Real Analysis; Math 784, Topology; C S 610, Operating System Fundamentals; C S 611, Assembler-Language Programming; C S 612, Data Structures and Processes.

3. Two free electives.

Bachelor of Science
Interdisciplinary Programs in Mathematics and Its Applications

These programs are designed to prepare students for employment in various areas of applied mathematics. Certain of them also lead to graduate work in appropriate fields (e.g., chemical physics, computer science, economics). In this program, the major may consist of mathematics combined with any one of the following disciplines: chemistry, computer science, economics, electrical science, fluid dynamics, mechanics, thermodynamics, statistics, and physics.

Each interdisciplinary major consists of ten mathematics courses plus five courses in the other discipline. Specific requirements follow. If more than five courses outside of mathematics are required or elected, the excess may be used to satisfy appropriate General Education Requirements.

Requirements

1. Sixteen full credit courses chosen from specified groups as required by the University.

Group I: Four courses chosen from an approved list of biological and physical science courses, excluding all courses in mathematics or computer science.

Group II: Six courses chosen from an approved list of social science, arts, and humanities courses. (In the Math-C S Option, Phil 550, Symbolic Logic, is strongly recommended.)

Group III: Six courses, two of which must be English 401 and C S 410 (Introduction to Computer Programming), chosen from all courses offered by the University, excluding all mathematics courses. (In the Math-C S Option, E E 531, Elements of Digital Systems, and E E 612, Logical Design of Digital Computers, must also be included in Group III.)

2. Ten mathematics courses chosen as follows—

Six required core courses: Math 425, Calculus I; Math 426, Calculus II; Math 527, Differential Equations; Math 528, Multidimensional Calculus; Math 531, Mathematical Proof (in the Math-C S Option this must be Math 531C, Discrete Computational Mathematics); Math 645, Applied Linear Algebra (or 761-762).

Four additional mathematics courses (note: mathematics electives must be chosen from mathematics courses numbered 682 or above, excluding 698, 703, 791); in the Math-Statistics Option this may include C S courses numbered 503 or above):

In the Math-C S Option: Math 644, Applied Probability and Statistics (or 735-6) and three approved math electives.

In the Math-Econ Option: Math 735, Probability; Math 736, Statistics; and two approved math electives.

In all other options: Math 644, Applied Probability and Statistics (or 735-6); Math 646, Analysis for Applications; Math 647, Complex Analysis for Applications; and one approved math elective.

3. Six additional courses as follows—

Mathematics-Chemistry Option: Chem 405, Introductory Chemistry (taken no later than sophomore year); Chem 683 & 685, Physical Chemistry

I, and Physical Chemistry Laboratory (these two courses regarded as a single unit); Chem 684 & 686, Physical Chemistry II, and Physical Chemistry Laboratory (these two courses regarded as a single unit); Chem 776, Physical Chemistry III; either Phys 701, Introduction to Quantum Mechanics I, or Chem 774, Inorganic Chemistry; and one free elective (note: Chem 547-548, Organic Chemistry, suggested as elective for those planning to do graduate work in chemical physics).

Mathematics-Computer Science Option: C S 610, Operating System Fundamentals; C S 611, Assembler Language Programming; C S 612, Data Structures and Processes; two more approved computer science courses, chosen from C S courses numbered 696 or above; and one free elective.

Mathematics-Economics Option: Econ 401, (Macro) Principles of Economics; Econ 402, (Micro) Principles of Economics; Econ 605, Intermediate Microeconomic Analysis; Econ 611, Intermediate Macroeconomic Analysis; two approved economics courses (chosen from the following: Econ 626, Introduction to Quantitative Economics; Econ 727, Advanced Econometrics; Admn 705/6, Operations Research; Econ 737, Decision Theory and Bayesian Methods).

Mathematics-Electrical Science Option: E E 541, Electrical Circuits; E E 548, Circuits and Electronics; E E 545, Electrical Networks; E E 603, Electromagnetic Fields and Waves I; E E 757, Fundamentals of Communications Systems; E E 782, Control Systems. (Note: E E 541 and 548 should be taken no later than the sophomore year.)

Mathematics-Fluid Dynamics Option: M E 503, Thermodynamics I; M E 508, Fluid Dynamics; M E 525, Mechanics I; M E 707, Analytical Fluid Dynamics; M E 708, Gas Dynamics; and one free elective.

Mathematics-Mechanics Option: M E 503, Thermodynamics I; M E 525, Mechanics I; M E 526, Mech. II; M E 527, Mech. III; and two of the following three courses: M E 723, Advanced Dynamics; M E 724, Vibration Theory and Applications; M E 727, Advanced Mechanics of Solids.

Mathematics-Physics Option: Phys 407, General Physics I; Phys 408, General Physics II; Phys 505, General Physics III; either Phys 701-702, Introduction to Quantum Mechanics I and II, or Phys 703-704, Electricity and Magnetism I and II; and one free elective. (Note: Phys 407-408 should be taken no later than the sophomore year.)

Mathematics-Statistics Option: either Math 767, One-Dimensional Real Analysis or 753, Numerical Methods and Computers I; five statistics courses: 735, Probability and 736, Statistics required; three approved electives chosen from: 737, Decision Theory and Bayesian Methods; 738, Multivariate Statistical Analysis; 739, Linear Statistical Models; 740, Nonparametric Statistical Methods; and 696, Independent Study.

Mathematics-Thermodynamics Option: M E 503, Thermodynamics I; M E 508, Fluid Dynamics; M E 525, Mechanics I; two of the following three courses—M E 701, Macroscopic Thermodynamics, M E 702, Statistical Thermodynamics, M E 703 Heat Transfer; and one free elective.

Mechanical Engineering

(For descriptions of courses, see page 154.)

Mechanical engineering is a challenging profession encompassing research, design, development, and production of aerospace vehicles, underwater vessels, instrumentation and control systems, nuclear and conventional power plants, and consumer and industrial products in general. The profession also makes contributions through more fundamental studies of material behavior, the mechanics of solids and fluids, and energy transformation.

The curriculum in mechanical engineering is designed to prepare prospective graduates either for more advanced studies or for beginning professional engineering careers. The program of study provides a foundation in the basic physical sciences, mechanics of solids and fluids, dynamic systems, thermal sciences, materials science, and design. Flexibility in the curriculum enables students to gain competence in any of these specific areas, developing abilities in analysis, experimentation, and engineering design. The curricula include elective courses in the arts, the humanities, and the social sciences to provide a liberal education.

The program in mechanical engineering is further designed to develop the creative potential to meet increasingly complex needs of industry, government, and education, while appreciating the role of technology in a modern society.

Students, with their advisers' assistance, should plan a program based on the following distribution of courses, which average 16 credit hours per semester and total not less than 128 credits.

The outline that follows is to be considered as being typical only in terms of format. Within the constraints of satisfying all of the requirements and having all necessary prerequisites, schedules may vary, generally because of scheduling needs or student preference.

Electives should be selected, in consultation with a departmental adviser, that will lead to a balanced program in the chosen area of interest. The free electives are entirely students' own choice. Technical elective requirements are four courses of at least three credits each. Some mechanical engineering elective courses may not be offered every year.

To enter the junior-year courses in the mechanical engineering major, students must have a 2.00 grade-point average or higher in the following courses: Phys 407, Phys 408, M E 503, M E 525, and M E 526.

Freshman Year		Fall	Spring
Engl 401	Freshman English	4*	—
Chem 405†	Introductory Chemistry	—	4*
Math 425 and 426	Calculus I and II	4	4
Phys 407-408	General Physics I and II	4	4
Elective	Any approved biological science	—	4*
M E 441	Engineering Graphics	4*	—
		16	16

Sophomore Year			
Math 527	Differential Equations with Linear Algebra	4	—
Math 528	Multidimensional Calculus	—	4
M E 525-526	Mechanics I and II	3	3
E E 535	Circuits and Signals	4	—
E E 536	Electronics and Electromagnetics	—	4
M E 561	Introduction to Materials Science	3	—
M E 561 L	Introduction to Materials Science Laboratory	1*	—
M E 503	Thermodynamics I	—	4
Elective (2)	Arts and humanities or social science	4	4
		19	19
Junior Year			
M E 527	Mechanics III	3	—
M E 628	Introduction to Vibrations	—	3
M E 508	Fluid Dynamics	4	—
M E 703	Heat Transfer	—	3
C S 410	Introductory Programming	2	—
C S 410 F	Scientific Programming with FORTRAN	2	—
M E 648	Introduction to Measurement and Experimental Methods	—	3
Electives (2)	Arts and humanities or social science	4	4
Elective (1)	Technical elective	—	3 (4)
		15	16(17)
Senior Year			
M E 771	Dynamic Systems Modeling	3	—
M E 655‡	Design Process and Project	1 or 3	—
Electives (3)	Technical electives	3 (4)	6 (8)
Electives (2)	Arts and humanities or social science	4	4
Elective (1)	"Free" elective	3 (4)	3 (4)
		16(18)	13(16)

*To facilitate scheduling, many students may be required to take this course in the alternate semester.
†Students whose preparation in chemistry is weak may be required to take a full year of chemistry; i.e., Chem 403-404.
‡If taken for 1 credit, an additional 2-credit project must be completed in an approved course.

Energy Option Many mechanical engineering graduates traditionally pursue professional careers in areas that are related to energy generation, conversion, or use. Increased emphasis on energy conservation and the development of alternate energy sources has created challenging and rewarding opportunities for graduates having a strong interest and capability in these fields. The Department of Mechanical Engineering offers a formal energy option intended to promote the development of well-planned student programs with special emphasis on courses applicable to career goals in energy related industries. This program of five courses, open to mechanical engineering majors, emphasizes those subjects necessary for an understanding of the engineering aspects of energy systems and related problem areas. Students electing the energy option should do so during the first semester of the junior year and have their program approved by a department faculty member involved in the option. To have the energy option shown on transcripts, students should file appropriate forms with the dean's office during the first semester of the junior year.

Required Courses	
(Minimum of four including M E 697)	
M E 504	Thermodynamics II
M E 697	Seminar (energy topics section)
M E 710	Solar Heating Systems
ChE 705	Natural and Synthetic Fossil Fuel
ChE 712	Introduction to Nuclear Engineering
Electives (1)	
M E 708	Gas Dynamics
M E 695A	Undergraduate Projects and Independent Study (Thermal Science)

Physics

(For descriptions of courses, see page 175.)

Physics is concerned with the properties of matter and the laws that describe its behavior. It is an exact science based on precise measurement, and its objective is the kind of understanding that leads to the formulation of mathematical relationships between measured quantities. As a fundamental science, its discoveries and laws are basic to understanding in nearly all areas of science and technology. Advances in such diverse fields as medical instrumentation, solid state electronics, and space research have relied heavily on the application of basic physical laws and principles.

Students interested in the study of physics at the University of New Hampshire will find a strong interaction between research and academic programs. Undergraduates have participated in research studies ranging from atomic spectroscopy using laser sources to astrophysical studies of the solar system using space probes. These experiences have proven beneficial to engineering and physics students alike. The department has its own library, which provides a comfortable, inviting atmosphere for study and relaxed reading.

The suggested programs that follow are indicative of the flexibility available to students, whether they are preparing for graduate work in physics, industrial opportunities, governmental research, secondary-level teaching, or a general education that might utilize the fundamental knowledge of physics.

The following undergraduate degree programs are offered through the Department of physics. Interested students may consult with the department chairperson.

Bachelor of Science in Physics

This degree is the professional program offered by the department. The required courses are those necessary for admission to graduate work or a career in industry. Additional courses may be beneficial for graduate preparation or may be desirable for more depth in certain areas of physics. Students are strongly advised to learn French, German, or Russian.

Requirements

1. Satisfy General Education Requirements.
2. Satisfy Bachelor of Science requirements (page 50).
3. One course in English is required in addition to the University requirement.
4. Minimum physics requirements: 407, General Physics I; 408, General Physics II; 505, General Physics III; 516, Physical Mechanics; 602, Thermal Physics; 605, Experimental Physics I; 606, Experimental Physics II; 705, Experimental Physics III; 701-702, Introduction to Quantum Mechanics I and II; and 703-704, Electricity and Magnetism I and II.
5. Chemistry: 403-404.
6. Math: 425-426; 527-528; 646; and one elective. In addition, C S 410 is strongly recommended.

Physics Electives

Additional physics courses may be selected from the following: 607,* Optics; 706,** Experimental Physics IV; 713, 714, Special Topics I and II; 718,* Introduction to Solid State Physics; 795, 796, Independent Study; 710, Introduction to Astrophysics.

Suggested Curriculum for Bachelor of Science Degree in Physics

Freshman Year		Fall	Spring
Phys 407-408	General Physics I and II	4	4
Math 425 and 426	Calculus I and II	4	4
Chem 403-404 (or Chem 405 and Elective)	General Chemistry	4	4
Engl 401	Freshman English	4	—
Elective	Arts/humanities	—	4
		16	16

Sophomore Year			
Phys 505	General Physics III	4	—
Phys 516	Physical Mechanics	—	4
Math 527	Differential Equations with Linear Algebra	4	—
Math 528	Multidimensional Calculus	—	4
Engl Elective	Any English course	4	—
C S 410 (elective)	Introduction to Computer Programming	—	4
Electives (2)	Social science	4	4
		16	16

Junior Year			
Phys 602 (607*; 618*)	Thermal Physics (Optics; Solid State)	4	—
Phys 701	Quantum Mechanics I	—	4
Phys 605-606	Experimental Physics I and II	4	4
Biol Elective	Any Group I approved course	—	4
Math 646	Analysis for Applications	4	—
Math elective		—	4
Elective	Arts/humanities	4	—
		16	16

Senior Year			
Phys 702	Quantum Mechanics II	4	—
Phys 703-704	Electricity and Magnetism I and II	4	4
Phys 706†	Experimental Physics IV	—	4
Electives (2)	Unrestricted	4	4
Electives (2)	Unrestricted	4	4
		16	16

*May be substituted for Phys 602 upon approval of the department.
†May be substituted for Phys 705 at any time.

Bachelor of Arts, Physics Major

This degree provides an opportunity for a broad and liberal education, which in some cases may be sufficient for graduate work. A judicious choice of electives may also prepare students for interdisciplinary programs that require proficiency in a restricted area of physics.

Requirements

1. Satisfy General Education Requirements.
2. Satisfy Bachelor of Arts degree requirements (page 16).
3. Phys 407-408, 505. Note that Math 425 and 426 are prerequisites for some of the courses.
4. Five additional courses in physics approved by the department, three of which must be at the 500 level or above.
5. Math requirements: 425, Calculus I, and 426, Calculus II.

Bachelor of Arts, Science Major, Physics Concentration

This is the most flexible degree offered by the department. It is not designed to produce a professional physicist but, rather, to provide an opportunity for interdisciplinary combinations with emphasis on physics.

Requirements

1. Satisfy General Education Requirements.
2. Satisfy B.A. degree requirements (page 16).
3. Physics requirements: six courses approved by the department.
4. Math requirements: 425, Calculus I, and 426, Calculus II.
5. Any three approved courses in science not used to satisfy other University requirements.

Bachelor of Arts, Chemistry and Physics Teaching

For information, see page 55.

School of Health Studies

Basil J. F. Mott, Dean
Robert Puddy, Associate Dean

Departments and Programs

Communication Disorders
Health Administration and Planning
Medical Technology
Nursing
Occupational Therapy
Physical Education
Recreation and Parks

Programs of Study

Bachelor of Science

Communication Disorders
Health Administration and Planning
Medical Technology
Nursing
Occupational Therapy
Physical Education
- Teacher Certification
- Athletic Training
- Exercise Specialist in Health Maintenance
- Pre–Physical Therapy
- Sports Communication

Recreation and Parks
- Recreation Administration
- Recreation Programming
- Recreation Resources Management

Purposes and Programs

The School of Health Studies, established in 1968, is one of the newest academic components of the University. It was created in response to the growing need for programs in higher education that prepare young men and women for health and health-related careers. Currently, the school offers undergraduate instruction leading to the Bachelor of Science degree in communication disorders, health administration and planning, medical technology, nursing, occupational therapy, physical education, and recreation and parks. Each program has been designed to enable students to acquire the basic knowledge and skills needed to practice their chosen professions and at the same time to obtain a broad cultural background in the humanities and social sciences.

Undeclared Major* A very limited number of well qualified students, who have expressed an interest in a health-related career, but who are undecided about a specific major, may enter the School of Health Studies as undeclared students. The program of study for undeclared students includes the following required courses:

Engl 401	Freshman English
Psyc 401	Introduction to Psychology
Zool 507-508	Human Anatomy and Physiology

Undeclared students should explore possible majors by taking courses in the programs that interest them most.

Recommended Courses:

Chem 403-404	General Chemistry
Comm 520	Survey of Communication Disorders
HAP 401	Health Care Systems
HAP 402	Public Health and Epidemiology
Nutr 475	Nutrition in Health and Disease
MedT 401	Introduction to Medical Technology
Nurs 505	Nursing—A Developing Profession
PhEd 500	Perspectives in Physical Education
Polt 402	American Government and Politics
Psyc 581	The Study of Child Behavior
RecP 455	Introduction to Recreation and Park Services
Soc 400	Introductory Sociology

Undeclared students should be prepared to declare a major by April when they preregister for the fall semester of the sophomore year.

*Limited to entering freshmen only.

Degree Requirements

Candidates for the B.S. degree must satisfy all General Education Requirements for graduation as listed on page 14, earn at least 128 credits, successfully complete the courses required in one of the curricula described in this section, and achieve the required minimum grade-point average in the chosen curriculum. Generally, courses are to be completed in the sequence in which they are arranged.

Minors: See page 17 for requirements.

Dual-Degree Programs: See page 16 for requirements.

Student-Designed Majors: See page 80 for requirements.

Second Majors: See page 17 for requirements.

Student Liability Insurance All students whose programs require participation in clinical learning experiences must purchase and maintain liability insurance for the entire clinical experience. Proof of such insurance coverage must be furnished to the department before the clinical experience begins. The University has arranged for appropriate insurance coverage at a modest cost to students. Further information may be obtained at major department offices.

Programs of Study

Communication Disorders

(For descriptions of courses, see page 115.)

Communication disorders is the profession devoted to helping people overcome disabilities of speech, language, or hearing. Specialization in communication disorders begins in the freshman year. Students learn about speech, language, and hearing disorders in the usual classroom setting and then become involved in clinical practice. This opportunity is provided in an on-campus clinic and in schools and community rehabilitation clinics off campus. Students are encouraged to take elective courses in psychology, sociology, and human development.

Students' professional education should be continued at colleges or universities offering graduate programs leading to a master's degree and to subsequent certification by the American Speech and Hearing Association. Certified clinicians find employment opportunities in hospitals, schools, community speech and hearing clinics, or private practice.

Students in the Communication Disorders Program must: 1) complete a course in statistics; 2) obtain at least a 2.67 grade-point average in their first three communication disorders courses; and 3) maintain a minimum 2.67 grade-point average in all communication disorders courses. The required courses in communication disorders, which all students in the program must successfully complete, are: 520, Survey of Communication Disorders; 521, Anatomy and Physiology of the Speech and Hearing Mechanism; 524, Applied Phonetics of American English; 631, Speech Pathology I; 632, Speech Pathology II; 634, Clinical Practice in Speech Pathology; 638, the Acquisition of Language; and 704, Basic Audiology. Other elective courses are available.

Students interested in this program should consult with the chairperson, F. Harry Tokay.

Health Administration and Planning

(For descriptions of courses, see page 140.)

Students in the Health Administration and Planning Program are prepared to embark upon ad-

ministrative and planning careers in hospitals and health care agencies. Graduates work in various settings, such as medical centers, hospitals, long-term care facilities, official health agencies, community mental health centers, insurance agencies, home health agencies, neighborhood health centers, environmental health agencies, and regulatory agencies.

The academic program is interdisciplinary, with undergraduates taking courses in many academic units of the University. Students gain a broad view of health and develop analytical skills in such areas as economics, politics, and management—all applicable to health organizations. The curriculum is organized to assist students in developing competencies in five areas. A list of these competencies is available from the program office.

Two plans are available for achieving the competencies required for graduation: the academic program for full-time students who have recently graduated from high school and the adult experiential option designed primarily for individuals who have substantial professional experience and desire to pursue the course of study while maintaining their professional affiliation.

Academic Program for Full-time Students

Competencies are achieved through four components of the curriculum: University General Education Requirements, core area, special interest area, and collateral studies. Students must work closely with their assigned advisers to develop a plan of study for each of these components.

General University Requirements Advisers can assist students in selecting courses that will satisfy certain program expectations and simultaneously meet University General Education Requirements.

Core Area Students will enroll in 1) introductory courses: HAP 401, Health Care Systems; HAP 402, Public Health and Epidemiology; HAP 502, Health and Medical Concepts; and 2) integrative courses: HAP 701, Health Administration and Planning Methods; HAP 702, Hospitals and Health Care Delivery Agencies: Interorganizational Relations; HAP 704, Financial Management of Health Care Institutions; HAP 721, Hospital and Health Services Administration; and HAP 723, Health Planning.

Special Interest Area Students will select a health institution or a planning or administrative function within it as an area of focus. This selection usually occurs during the fall of the junior year, before the field practicum. The 16-week field practicum, an essential part of the academic program, helps integrate classwork through a supervised work experience and allows students to explore an area of special interest in depth. Courses include: HAP 621, Health Administration and Planning Prepracticum Seminar; and HAP 622, Health Administration and Planning Field Practicum. Field Practicum sites are selected by faculty and located throughout northern New England.

Electives are selected, with the guidance of the adviser, to increase an understanding of the special interest area.

Collateral Area A basic understanding is expected in the following areas: economics, politcal science, organizations, accounting, and statistics. Advisers will work with students to select the courses appropriate for their interests.

Program Review The faculty reviews student performances during the semester before the practicum to determine each student's readiness.

Experiential Option for Adult Learners

This option is designed to make the B.S. with a major in health administration and planning more accessible to mature learners, many of whom have already begun a health care career. Previous learning experiences are assessed in relation to competencies established as part of degree requirements through HAP 700—Competency Assessment. Innovative educational technologies are used to aid independent learning. Many adult learners pursue the degree while continuing to work full time without living in the Durham area. Students interested in the program should consult with the chairperson.

Medical Technology

(For descriptions of courses, see page 157.)

Medical technology is a challenging and rewarding profession for students interested in laboratory medicine. Medical technologists are vital members of the health team who perform various medical laboratory tests and provide the diagnostic assistance required in modern patient care. Medical technologists may be employed in hospitals, research, or a variety of industrial settings.

Students entering the program spend their freshman and sophomore years on campus. During their junior year, one semester (17 weeks) will be spent at an area hospital where students will complete clinical courses MedT 651–654. During the spring semester of the senior year, approximately 26 weeks will be spent at Mary Hitchcock Memorial Hospital in Hanover, New Hampshire, where students will complete clinical courses MedT 751–754. Student costs for the clinical affiliations, in addition to University tuition, may include room and board charges by the hospitals. Upon successful completion of the program, students are awarded a B.S. degree and are qualified to take a national certification examination.

Academic requirements are as follows. Students must obtain a grade of C (2.00) or better in Micr 503 and 702, Chem 545–546, Bchm 656, and all medical technology courses. By the end of the spring semester, sophomore year, a student must have attained a cumulative grade-point average of 2.50. Evaluation of students' academic performance and personal interviews with the clinical faculty are required before the end of the spring semester of the sophomore and junior years.

Students interested in this program should consult the chairperson, Karol LaCroix.

Career Mobility Option This option is designed to make the B.S. degree in medical technology available to certified laboratory assistants, medical laboratory technicians, military trained laboratory personnel, and other individuals with at least two years of full-time recent experience in the clinical laboratory. This may be done on a full- or part-time basis by taking prerequisite courses at UNH or other accredited institutions throughout the state. Students have the opportunity to challenge clinical course requirements through credit by examination. A series of written and practical examinations is available in the areas of chemistry, hematology, urinalysis, microbiology, immunohematology, and immunology. Students interested in the option should contact the chairperson of the Medical Technology Program.

Freshman Year		Fall	Spring
MedT 401	Introduction to Medical Technology	—	0
Zool 507-508	Human Anatomy and Physiology	4	4
Chem 403-404	General Chemistry	4	4
Engl 401	Freshman English	4	—
Electives (3)		4	8
		16	16
Sophomore Year			
Chem 545-546	Organic Chemistry	—	5
Micr 503	General Microbiology	5	—
MedT 625	Clinical Lab Methods I	4	—
MedT 626	Clinical Lab Methods II	—	4
Micr 702	Pathogenic Microbiology	—	4
Electives (3)		8	4
		17	17
Junior Year*			
MedT 651	Clinical Microbiology	4	—
MedT 652	Clinical Hematology	4	—
MedT 653	Clinical Immunohematology	4	—
MedT 654	Clinical Chemistry	4	—
Bchm 656	Physiological Chem and Nutrition	—	4
MedT 720	Clinical Mycology/ Parasitology	—	4
Zool 504	Heredity and Evolution	—	4
Elective (1)		—	4
		16	16
Senior Year†			
Chem 517-518	Quantitative Analysis	5	—
Micr 705	Immunology and Serology	4	—
MedT 602	Med Lab Seminars	1	—
MedT 751	Diagnostic Microbiology	—	4
MedT 752	Advanced Hematology	—	4
MedT 753	Advanced Immunohematology	—	4
MedT 754	Advanced Clinical Chemistry	—	4
Math 636	Statistics	4	
Elective (1)		4	—
		18	16

*Students will affiliate at area hospitals during Semester I or II. Individual schedules will vary.
†Students will spend the spring semester at Mary Hitchcock School of Medical Technology in Hanover, New Hampshire.

Nursing

(For descriptions of courses, see page 163.)

The baccalaureate program aims to develop the student as a skilled practitioner of nursing with abilities to assist individuals or groups in promoting health needs, preventing illness, and caring for the sick. The student functions from a background of knowledge in the liberal arts and humanities and in the sciences basic to nursing, as well as in nursing itself. The objectives are to help the student gain necessary knowledge and skills to practice nursing in a variety of health care facilities, to foster accountability and commitment in the student, and to help individuals maximize their level of health.

The graduate is able to begin the practice of nursing and therefore can: 1) assess the needs of an individual for nursing care, 2) develop, implement, and evaluate a plan of care, 3) provide care from a framework of behavioral and natural sciences, 4) function as an advocate for clients, and 5) work as a collaborative member of a health team. A student who completes the requirements for the Bachelor of Science degree is eligible to take the state board examination and has the background required to pursue graduate study. The program is accredited by the National League for Nursing.

Hospitals and many community health-related agencies are used for learning experiences. Students are responsible for their own transportation to the clinical laboratories as well as for purchase of uniforms to be worn there. A physical examination and selected immunizations, at student expense, are required within the six months before the first clinical nursing course.

All generic nursing students must pay a lab fee each semester. Liability insurance coverage is required of all students in clinical courses.

All students are required to take the following prerequisite courses: 1) Prior to entering the first nursing course (Nurs 505): Engl 401, Zool 507-508, Psyc 401, and Soc 400; 2) Prior to entering the junior year nursing courses: Bchm 501, Micr 501-502, FCS 525, Nutr 475, and Statistics.

All students are required to achieve a minimum of C (2.00) in *each* prerequisite course. A cumulative grade-point average of 2.33 must be attained by the end of the sophomore year and maintained throughout each semester of the junior and senior years. Students must earn a minimum grade of C (2.00) in both classroom (theory) and clinical (practice) components of each nursing course in order to pass that course and progress to the next level.

Expanding Baccalaureate Opportunities for Registered Nurses: EBORN

RN students who hold a current license to practice as a registered nurse are admitted to the baccalaureate program. The baccalaureate degree for RNs is designed as an individualized, competency-based program which permits a variable learning pace and continuation of present work and/or family responsibilities. Advanced standing and course

credit in the B.S. program may be earned through transfer credit and challenge examinations. The program does not include blanket endorsement of all previous education. However, credits in the nursing component are awarded for documented knowledge and competence gained through previous educational and work experiences. Individualized plans of study enable the student to meet the standards of the remaining areas of professional nursing competence. The length of the program depends upon an individual's past experiences, interest and ability to achieve, and advanced placement.

Students interested in this program should consult with the chairperson, Juliette Petillo.

Freshman Year		Fall	Spring
Engl 401	Freshman English	4	—
Psyc 401	Intro. to Psychology	—	4
Zool 507-508	Human Anatomy & Physiology	4	4
Soc 400	Introd. Sociology	—	4
Nutr 475	Nutrition in Health & Disease	4	—
Electives (2)		4	4
		16	16
Sophomore Year			
Bchm 501	Biological Chemistry	4	—
Micr 501	Public Health Microbiology	3	—
Micr 502	Public Health Microbiology Laboratory	1	—
Nurs 505	Nursing—A Developing Profession	2	—
FCS 525	Human Development	—	4
Nurs 510	Foundations of Nursing Practice	—	4
Statistics		—	4
Electives (3)		6–8	4
		16–18	16
Junior Year			
Core courses			
Nurs 601	Nursing I	4	—
Nurs 610	Nursing II	—	4
Modular courses*		8	8
Nurs 601C	Nursing of Adults I		
Nurs 601D	Nursing of Children		
Nurs 601E	Nursing of the Childbearing Family		
Nurs 610C†	Nursing of Adults II		
Nurs 610D†	Nursing in the Community		
Nurs 610E†	Nursing in Mental Health		
Electives (2)		4	4
		16	16
Senior Year			
Core courses			
Nurs 621	Nursing III	4	—
Nurs 629	Nursing Research	—	2
Nurs 630	Nursing Leadership	—	2
Modular courses*		8	8
Nurs 610C	Nursing of Adults II		
Nurs 610D	Nursing in the Community		
Nurs 610E	Nursing in Mental Health		
Nurs 621C	Nursing of Adults III		
Nurs 630C	Senior Practicum		
Electives (2)		4	4
		16	16

*Each student will be assigned two 4-credit modules per semester.

†All Nurs 610 modules not completed in the junior year must be taken in the senior year.

Occupational Therapy

(For descriptions of courses, see page 167.)

The curriculum is accredited by the Committee on Allied Health Education and Accreditation/ American Medical Association in cooperation with the Accreditation Committee of the American Occupational Therapy Association. Two years of liberal arts courses and two years of professional study constitute the prescribed program leading to the Bachelor of Science degree. The program includes five major areas: the basic human sciences, the human development process, the health-illness-health continuum, specific life tasks and activities, and occupational therapy theory and practice. Occupational therapy practice is directed toward enabling or restoring individual capacity for functional independence and adaptation in the context of clients' environments. Observation and guided practice in local clinical situations are an integral part of several courses.

Following completion of the four-year academic program, students are placed in three, three-month full-time fieldwork experiences. Completion of these three placements qualifies students to sit for the national certification examination of the American Occupational Therapy Association.

To continue in the major, students must meet the following criteria:

1. By the end of spring semester, freshman year, the student must have a 2.33 cumulative grade-point average in Engl 401, Psyc 401, and Psyc 581.
2. By the end of fall semester, sophomore year, the student must have a minimum of C (2.00) in O T 510 and Zool 507.
3. By the end of spring semester, sophomore year, the student must have:
   a) a 2.33 cumulative grade-point average in courses required for the major;
   b) a minimum grade of C (2.00) in O T 512, Zool 508, and Psyc 461;
   c) completed one O T 588-Level I Fieldwork experience.
4. By the end of spring semester, junior year, the student must have a 2.33 cumulative grade-point average in courses required for the major and have completed two O T 588-Level I Fieldwork experiences.

5. To qualify for graduation, the student must have:
   a) a 2.33 cumulative grade-point average in courses required by the major, with the exception of the course in statistics;
   b) a minimum grade of C (2.00) in PhEd 606, 652; O T 515, 581, 582, 583, 624, 633, and 634 (these may be repeated only once);
   c) successful completion of O T 588.

Courses required for the major are those specified in the following list with the exception of electives. Curriculum review and revision is undertaken annually; students are expected to check with their departmental advisers in September for updated policies and requirements. Students are responsible for transportation to off-campus clinical and other learning experiences and must purchase personal liability insurance for coverage for the clinical components of the curriculum.

Freshman Year		Fall	Spring
Engl 401	Freshman English	4	—
Psyc 401	Introductory Psychology	4	—
Psyc 581	Child Development	—	4
Electives (5)		8	12
		16	16
Sophomore Year			
Any Sociology course except SOC 602		4	—
Zool 507-508	Human Anatomy & Physiology	4	4
O T 510	Occupational Therapy Theory	4	—
O T 512	Treatment Media Analysis I	—	2
O T 531	Group Process	2	—
O T 600	Developmental Tasks of Adulthood	—	4
Psych 461	Clinical Approaches to Human Behavior	—	4
Elective		2	2
		16	16
Junior Year			
O T 515	Treatment Media Analysis II	4	—
O T 581	Medical Concepts for Occupational Therapists	4	—
PhEd 652	Clinical Kinesiology	4	—
O T 582	Rehabilitation Techniques	—	4
O T 583	Occupational Therapy Psychiatric Foundations	—	4
PhEd 606	Neurology	—	4
Electives (2)		4	4
		16	16
Senior Year			
O T 588	Level I Fieldwork	—	1
O T 624	Occupational Therapy Treatment of Psychosocial Dysfunction	4	—
O T 633	Occupational Therapy Treatment for Physical Disabilities	4	—
O T 634	Systems of Therapeutic Intervention in Physical Disabilities	—	4
O T 691	Senior Project-Design	1	—
O T 692	Senior Project-Implementation	—	1
O T 697	Organization and Administration	2	—
O T 698	Senior Seminar	—	1
One statistics course from the following: Soc 602 or Psyc 402 or PhEd 668 or Math 636 or INER 701 or INER 528 or Educ 785		3/4	—
Electives		2/1	9
		16	16
Clinical Fieldwork Experiences			
O T 711 or O T 712 or O T 713	Psychosocial Dysfunction Physical Dysfunction Special Area		

Upon completion of the prerequisite courses, students are scheduled for a minimum of nine months' supervised clinical fieldwork placements. These Level II Fieldwork experiences are scheduled in centers that have established educational programs and are approved by the department. The fieldwork experiences are divided into three-month periods as follows: O T 711, Psychosocial Dysfunction; O T 712, Physical Dysfunction; O T 713, Special Area. A physical examination including a tuberculin test is required before fieldwork experiences. Proof of poliomyelitis immunization is also required. Students are required to purchase liability insurance and health insurance for their off-campus Level II Fieldwork experiences. Level II Fieldwork is the fifth year of preparation for entry to the field. A fee is charged for the coordination of Fieldwork.

Eligible graduates make application for the June or January national certification examination through the department. A $75 fee is currently charged by the American Occupational Therapy Association for this examination.

Curriculum revisions are being considered; information will be available during new-student summer orientation and during the first week of classes.

Students interested in this program should consult the chairperson, Barbara Sussenberger.

Physical Education

(For descriptions of courses, see page 171.)

The department of Physical Education offers five areas of study for majors: 1) teacher certification option; 2) athletic training option; 3) exercise specialist in health maintenance option; 4) pre-physical therapy option; and 5) sports communication option. Openings in options 2, 3, 4, and 5 are limited, and option 4 is not open to entering freshmen.

The teacher certification option provides a specialized professional background and a broad general education. Students may pursue coursework to

prepare as generalists (all grade levels), or as either elementary or secondary specialists in physical education. In addition to the above, students enrolled in the teacher certification option in physical education may elect to pursue an athletic training option. A cumulative grade-point average of 2.20 and a grade-point average of 2.50 in all physical education courses are required to be eligible for student teaching.

Students must complete the following coursework before student teaching: 1) all required major activity courses, 2) either PhEd 563 or PhEd 692, 3) three of the following: PhEd 620, 625, 668, 775.

Students must earn a grade of C (2.00) or better in each of the required physical education courses if majoring in pre–physical therapy or sports communication. Students must earn a grade of C (2.00) or better in every required course if majoring in exercise specialist in health maintenance.

Students who wish to minor in physical education must complete 20 credits of coursework which have been approved by a department minor adviser. No more than 6 of the 20 credits may be earned through activity or coaching courses.

Students interested in majoring or minoring in physical education should consult the chairperson, Allan Waterfield.

Teacher Certification Option

Required Physical Education Courses		Credits
PhEd 470-479	Physical Education Activities (for men and women)	7
and one of the following: PhEd 447, 520, 527, 533, 534		1
PhEd 480-482, 484, 485	Physical Education Activities (for men)	2.5
PhEd 484, 486-492	Physical Education Activities (for women)	3.5
One from the following: PhEd 410, 415, 416, 427, 428, 435, 437, 438, 439, 453, 533, 534		0.5/1.0
One course from the following: PhEd 411, 412, 414, 417, 420, 421, 422, 423, 424		0.5
PhEd 500	Perspectives in Physical Education	4
PhEd 501	Advanced First Aid and Emergency Care	2
PhEd 610	Adapted Physical Education	4
PhEd 620	Physiology of Exercise	4
PhEd 668	Measurement Procedures in Physical Education	4
PhEd 775	Perceptual Motor Learning	4
One of the following:		
PhEd 563	The Theory of Teaching Physical Education in the Secondary School	4
PhEd 692	Theories of Teaching Physical Education in the Elementary School	4
One of the following:		
PhEd 625	Dynamics of Human Movement	4
PhEd 652	Clinical Kinesiology	4
Education Courses		
Educ 500	Exploring Teaching	4
Educ 700	Educational Structure and Change	4
Educ 701	Human Learning and Development	4
Educ 705	Alternative Perspectives on the Nature of Education	4
Educ 694	Supervised Teaching of Physical Education	8
University Required Courses		
Psyc 401	Introduction to Psychology	4
Zool 507-508	Human Anatomy and Physiology	8

Athletic Training Option This option prepares individuals for careers as athletic trainers. In addition to the courses listed below, work as a student trainer will be available to the student. Eligibility for the national certification examination requires 1,800 hours of practical work. PhEd 703 provides 800 hours. Students may elect to complete both the teaching certification option and the athletic training option, which normally will require four and one-half to five years.

Physical Education Required Courses		
PhEd 501	First Aid	2
PhEd 502	Basic Athletic Training	4
PhEd 503	Athletic Training Applied Techniques	2
PhEd 610	Adapted Physical Education	4
PhEd 620	Physiology of Exercise	4
PhEd 652	Clinical Kinesiology	4
PhEd 606	Neurology	4
PhEd 702	Advanced Athletic Training	4
PhEd 703	Laboratory Practice in Athletic Training	8
PhEd 722	Graded Exercise Testing and Exercise Prescription	3
PhEd 780	Psychological Factors in Sport	4
PhEd activity courses	PhEd 475 (0.5 cr); PhEd 470 (1 cr); an individual sport (0.5 cr); a team sport (0.5 cr); a coaching course (2 cr)	4.5
		47.5
University Required Courses		
Nutr 605	Principles of Nutrition	4
SHS 400	Health-Human Values	4
Psyc 401	Introducrion to Psychology	4
Engl 401	Freshman English	4
Zool 507-508	Anatomy and Physiology	8
		24
Recommended Courses		
Chem 403-404 or Chem 405	General Chemistry	4–8
Phys 401	Introduction to Physics I	4
OT 581	Medical Conceprs	4
		12–16

Exercise Specialist in Health Maintenance Option
This curriculum prepares individuals for career opportunities in adult fitness programs in communities, industry, and health agencies. Exercise specialists work in physical activity programs of prevention, intervention, and cardiac rehabilitation. Students must complete all required physical education courses prior to enrolling in PhEd 650. Required courses are:

Physical Education Courses		
PhEd activities	(must include 475 and one of the following: 447, 520, or 527)	6
PhEd 501	Advanced First Aid and Emergency Care	2
PhEd 502	Basic Athletic Training	4
PhEd 620	Physiology of Exercise	4
PhEd 621	Exercise Laboratory Techniques	3
PhEd 650	Exercise Specialist Internship	8
PhEd 652	Clinical Kinesiology	4
PhEd 668	Measurement Procedures in Physical Education	4
PhEd 722	Graded Exercise Testing and Exercise Prescription	3
PhEd 732	Electrocardiography	4
University Required Courses		
Nutr 475	Nutrition in Health and Disease	4
Bchm 501	Biological Chemistry	4
Psyc 401	Introduction to Psychology	4
Psyc 461	Clinical Approaches to Human Behavior	4
Zool 507-508	Human Anatomy and Physiology	8

Pre–Physical Therapy Option The pre–physical therapy curriculum provides the necessary courses for meeting admission requirements to a physical therapy certificate program. However, satisfactory completion of all UNH degree requirements does not guarantee admission to one of the several physical therapy schools. In addition to the required courses listed below, work experience in a rehabilitation setting is highly recommended.

Physical Education Courses		
PhEd major activities	(must include 470, 472, and either 520 or 527)	6
PhEd 502	Basic Athletic Training	4
PhEd 606	Neurology	4
PhEd 620	Physiology of Exercise	4
PhEd 652	Clinical Kinesiology	4
PhEd 722	Graded Exercise Testing and Exercise Prescription	3
PhEd 775	Perceptual Motor Learning	4
One of the following:		
PhEd 675	Motor Development of the Young Child	4
PhEd 740	Perceptual Motor Dysfunction	4
University Required Courses		
Chem 403-404	General Chemistry	8
Phys 401-402	Introduction to Physics I and II	8
Psyc 401	Introduction to Psychology	4
Soc 500	Social Psychology	4
Zool 507-508	Human Anatomy and Physiology	8
One of the following:		
Psyc 531	Psychobiology	4
Psyc 461	Clinical Approaches to Human Behavior	4
Psyc 711	Sensation and Perception	4
One of the following:		
FCS 525	Human Development	4
Psyc 581	Child Development	4
One of the following:		
Math 636	Introductory Applied Statistics	4
INER 528	Applied Statistics I	4
INER 701	Statistical Methods I	4
Psyc 402	Statistics and Methodology in Psychology	4
Soc 602	Statistics	4

Sports Communication Option The sports communication option combines substantive knowledge in sport with skills in mass communication, including sportswriting and sportscasting. A grade of B– or better is required in Engl 501 to continue this option. Most students in the sports communication option also participate in the English Department journalism program. For these students, an excellent record of performance in the writing courses is required. An internship experience is recommended for highly qualified students. Required courses are as follows.

Physical Education Courses		
PhEd activities		6
PhEd coaching courses		6
PhEd 633	Social Foundations of Sport and Physical Activity	4
PhEd 635	Sport in Literature	4
PhEd 636	Introduction to Sports Information	2
PhEd 668	Measurement Procedures in Physical Education	4
PhEd 780	Psychological Factors in Sport	4
PhEd 791	History of Physical Education	4
University Required Courses		
Engl 501	Introduction to Prose Writing	4
Engl 621	Newswriting	4
Psyc 401	Introduction to Psychology	4
Soc 400	Introductory Sociology	4
ThCo 402	Communication I	4
ThCo 403	Public Speaking	4
One of the following groups of courses:		
Engl 622	Newswriting	4
Engl 703	Advanced Nonfiction Writing	4
ThCo	Elective (a communication course)	4
ThCo 555	Introduction to Mass Communication	4
ThCo 556	Introduction to Television Production	4
Engl	Elective (a writing course)	4

Recreation and Parks

(For descriptions of courses, see page 183.)

Career opportunities in recreation and parks are good—and expanding. As Americans have more

leisure time, and the amount of leisure is likely to increase, the quality of our lives will be influenced more and more by the way we use this important resource.

The recreation and park field is a diversified profession for students interested in working with people and/or this nation's natural, historical, or cultural resources. Recreation and leisure services are provided in a wide variety of settings in the public, private, and commercial sector. Graduates can expect to find employment with a diverse group of employers, such as: municipal recreation and park departments, youth service agencies, health care facilities, federal and state park agencies, industrial firms and commercial organizations, and colleges and universities.

The undergraduate curriculum in recreation and parks offers three areas of study for majors: Recreation Administration Option; Recreation Resources Management Option; and Recreation Programming Option.

Each option leads to a Bachelor of Science degree. Students must earn a grade of C (2.00) or better in each of the required recreation and park courses. Students majoring in recreation and parks must complete 128 credit hours for the degree.

Core Courses

All students in the program must complete a core curriculum of eight courses: RecP 455, Introduction to Recreation and Park Services; RecP 501, Leisure Services for the Handicapped; RecP 557, Introduction to Leadership and Programming; RecP 664, Field Work; RecP 663, Recreation and Park Administration; RecP 798, Seminar in Leisure; Admn 611, Behavior in Organizations; ThCo 403, Public Speaking.

Field work is an eight-credit module designed to bridge the gap between theory and practical application. Students, working with their advisers and the field work coordinator, select an appropriate setting, based on their professional and career interests. They must complete a minimum of 400 hours of supervised field study. Specific requirements are identified in the Field Work Manual available from the Recreation and Parks Office.

Recreation Administration This option is designed to identify and develop the abilities that will prepare students for administrative and supervisory positions in a wide variety of human service organizations in the recreation field. In addition to the core curriculum, students complete the following requirements: RecP 454, Special Facility Operations; RecP 667, Recreation Resource Planning; RecP 772, Legal and Financial Aspects of Delivery Systems; one RecP elective; Polt 402, American Politics and Culture; Polt 500, American Public Policy; Polt 503, Local Government and Politics; CD 507, Introduction to Community Development.

Students in the recreation administration option work with their adviser to develop an area of specialization consisting of the one recreation and park elective and five courses from related disciplines. Potential areas of specialization include: commercial recreation administration, community and social planning, computer science, grounds maintenance, park interpretation, public recreation administration, and recreation integration.

Recreation Resources Management This option is designed to identify and develop abilities that will prepare students for management positions in a variety of outdoor recreation and park settings that emphasize natural, historical, and cultural resources. Studies are concerned with planning, developing, and maintaining land and water resources for recreational purposes. In addition to the core curriculum, students complete the following requirements: RecP 454, Special Facility Operations; RecP 561, Introduction to Outdoor Recreation; RecP 661, Recreation and Resource Management; RecP 793A, Area and Site Planning; one RecP elective; Bot 412, Introduction to Botany; Hydr 504, Freshwater Resources; REco 411, Introduction to Resource Economics.

Students in the park management option work with their adviser to develop an area of specialization consisting of six courses—one recreation and park elective and five courses from related disciplines. Potential areas of specialization include: commercial recreation administration, computer science, general resource management, grounds maintenance, park interpretation, public recreation administration, recreation integration, resource planning, and resource policy.

Recreation Programming This option is designed to identify and develop abilities in planning, conducting, and supervising recreation activity programs in a variety of settings. Studies are concerned with the planning and organizing of programs, methods, and techniques of needs assessment and program implementation and evaluation. In addition to the core curriculum, students complete the following requirements: RecP 454, Special Facility Management; RecP 558, Recreation Program Development; two RecP electives; Soc 400, Introductory Sociology; Psyc 401, Introduction to Psychology; Soc 500, Introduction to Social Psychology; Soc 530, Race and Ethnic Relations.

Students in the recreation programming option work with their adviser to develop an area of specialization consisting of seven courses—two recreation and park electives and five courses from related disciplines. Potential areas of specialization include: arts, commercial recreation administration, community and social planning, computer science, general programming, park interpretation, public recreation administration, recreation integration, and theater and drama.

Note: students interested in professional preparation in therapeutic recreation are advised to consult with Lou G. Powell to develop a specialization.

Leisure and Recreation Study in Scotland A sixteen-week program sponsored by the American Universities International Program is held each year during the spring semester at the University of Edinburgh, Scotland. Registration is limited. One year prior to departure, curriculum director approval is required. Sixteen credits can be granted.

Whittemore School of Business and Economics

Dwight R. Ladd, Dean
George T. Abraham, Assistant Dean
Wayne M. Burton, Assistant to the Dean
Jo-Ann Kelly, Advising Coordinator
Nancy Bergin, Undergraduate Counselor
Barbara Coakley, Graduate Program Coordinator

Programs of Study

Bachelor of Arts
Economics

Bachelor of Science
Administration
Hotel Administration

Purposes and Programs

The Whittemore School of Business and Economics was established July 1, 1962, as the result of the efforts of the late Laurence F. Whittemore, noted industrialist and long-time trustee and chairman (1955–60) of the UNH Board of Trustees. Since 1969, the school has been housed in McConnell Hall, named for Dr. John W. McConnell, the fourteenth president of the University (1963–71).

The basic purpose of the undergraduate curricula in the Whittemore School is to combine the breadth of liberal education with the specifics of professional training in administration, economics, and hotel administration. Undergraduates enrolled in the Whittemore School programs must take a substantial part of their coursework in other colleges in the University in order to fulfill the General Education Requirements. Beyond those requirements, students are encouraged to elect additional courses in the arts, the behavioral and social sciences, the humanities, mathematics, and the natural sciences. Thus, students who complete the Whittemore School programs in administration, economics, and hotel administration are prepared for employment and graduate study in these and related fields.

Within the limits of its resources, the Whittemore School also intends to serve the needs of undergraduates elsewhere in the University for whom selected courses in administration, economics, or hotel administration are relevant and desirable complements to their primary course of study. To the extent the space is available after majors have enrolled, many Whittemore School courses, therefore, are open to nonmajors who have the prerequisite preparation.

Degree Requirements

The Whittemore School offers a Bachelor of Arts degree program in economics and Bachelor of Science degree programs in administration and hotel administration. Candidates for a degree must satisfy all of the University General Education Requirements for graduation as well as the particular requirements of the individual major program. Economics majors must also satisfy specific requirements associated with the Bachelor of Arts degree. (See page 16.) No Whittemore School course may be taken on a pass/fail basis by a student majoring in administration, economics, or hotel administration.

Modifications tend to occur in major programs during the four-year period of students' undergraduate careers. Students are expected to conform to these changes insofar as they do not represent substantive alterations in their course of study.

For information concerning advanced degrees, see the Graduate School catalog.

Advising System

Undergraduate advising in the Whittemore School is carried out jointly by undergraduate counselors and the faculty. The undergraduate counselors are based in the dean's office, where student academic records are kept. The counselors assist students in program planning, preregistration, understanding and meeting general academic requirements, and general academic and career decision making. The faculty draw on their experience, expertise, and interests to help students with course, program, and career selection.

Students are not officially assigned to faculty advisers, but are provided with a Whittemore School *Faculty Profiles* booklet, which contains considerable information about faculty members' education, experience, and current teaching and research interests. Undergraduates are encouraged to develop an advisory relationship with one or more faculty members on the basis of mutual interests. Students who prefer a more formally structured arrangement are urged to so inform the undergraduate counselor. All students are urged to seek as much assistance as they need, from whatever source, but are reminded that theirs is the ultimate responsibility for knowing and meeting the various academic requirements for a degree.

Independent Study/Internship

Juniors or seniors in the Whittemore School may elect the internship or independent study options for variable credit. For either option, the student must secure a faculty sponsor in the area of interest and submit a proposal prior to the semester in which the project is to be undertaken. Independent study normally involves research, while internships are usually undertaken with cooperation of an off-campus organization and involve the nonroutine, but practical application of skills and concepts acquired in a student's program.

Independent studies and internships require considerable self-direction and self-monitoring on the part of the student, and careful prior review of requirements with the undergraduate adviser is necessary.

The Washington internship is open to any major. See page 185.

Five-Year Programs: B.A.-M.B.A., B.S.-M.B.A.

The Whittemore School and the College of Engineering and Physical Sciences offer a joint program leading to a Bachelor of Science (B.S.) in chemical engineering, civil engineering, electrical engineering, or mechancial engineering and a Master of Business Administration (M.B.A.) in five years rather than the normal six. Similarly, with the College of Liberal Arts, the Whittemore School offers a joint program leading to a B.A. in French, history, philosophy, or psychology and an M.B.A. The College of Life Sciences and Agriculture and the Whittemore School offer a joint program leading to a B.S. in plant science and an M.B.A. See the individual college descriptions for details.

Programs of Study

Administration Program

(For descriptions of courses, see page 92.)

The administration program provides training for young men and women interested in managerial or administrative careers in business or in public or private institutions.

Since most graduates of the program elect to embark upon business careers, the major thrust is in that direction. However, as demand has grown in recent years for people able to apply businesslike methods to the problems of nonprofit institutions, such as hospitals, school systems, government departments, and other socially oriented organizations, the program's objectives have been broadened considerably to include all types of administration, rather than business only.

The curriculum offers professional education in the basic theories, principles, concepts, and analytical tools used by successful modern administrators, combining them with an introduction to some of the important functional areas of management. At the same time, typical students achieve a well-rounded education by selecting courses in the liberal arts and the sciences from other colleges and schools in the University.

The administration program consists of 11 required courses in three groupings, plus two required WSBE electives. Group A includes the core courses taken in the freshman and sophomore years. These focus on basic concepts, tools, and skills. Group B consists of four courses in the functional areas of organizational behavior, production, marketing, and finance, normally taken in the junior and senior years. Group C consists of Business and Its Environment and the final capstone course in administration, Business Policy. These are taken in the senior year.

Students must complete all Group A courses, achieving a minimum grade-point average of 2.00 in them, before any Group B courses may be taken, and all Group B courses must be completed before taking Group C courses. In order to graduate, students must achieve a grade-point average of at least 2.00 in the 13 major courses. Transfer credit can be applied only to Group A courses.

Students are encouraged to take advanced electives in areas of their interest and in relation to career goals. Faculty and the undergraduate counselors can provide useful information and guidance for choices of electives.

The Whittemore School also offers courses for nonmajors. Students interested in these courses should contact the Advising Office.

The recommended plan of study is given below:

Freshman and Sophomore Years (Group A)

Econ 401, Principles of Economics Macro; Econ 402, Principles of Economics Micro; Admn 403, Financial Accounting; Admn 424, Business Statistics; Admn 503, Managerial Accounting and Management Information Systems

Junior and Senior Years (Group B)

Admn 611, Behavior in Organizations; Admn 650, Operations Management; Admn 651, Marketing; Admn 653, Financial Management

Senior Year (Group C)

Admn 701, Business and Its Environment; Admn 703, Business Policy; two WSBE electives

Economics

(For descriptions of courses, see page 121.)

Economics is the study of the allocation of scarce resources among competing uses, either through use of conscious public policy ("planning") or through impersonal market forces. The analytical skills of economists are useful in evaluating alternative methods of achieving these goals and in the formulation of new approaches to problems in these areas.

The economics program is designed to introduce students to the tools of economic analysis and to an understanding of the areas to which they may be usefully applied.

While undergraduate training in economics does not qualify students as professional economists (those intending such a career should plan on graduate study), it is regarded by employers as a highly desirable background for business or governmental employment. In recent years, economics graduates have competed on a favorable basis for business and government jobs with graduates in other areas, including administration. Undergraduate economics training is an excellent background for graduate work in law, business administration, and international relations, as well as economics.

Students planning to pursue graduate study in economics should consult with their advisers or faculty members early in the academic program to assist in their selection of an appropriate graduate school and to aid in gaining admission.

Courses in economics, including a minor program, are open to nonmajors. Students majoring in other programs may find certain economics courses useful supplements to their own majors and an aid in future employment. Political science majors may be interested in courses in economic development, comparative economic systems, public finance, and government regulation of business; engineering and science students may be interested in courses in introduction to econometrics, and intermediate microeconomic analysis. Noneconomics majors with questions about the nature of various courses should feel free to question the economics faculty.

Economics majors must complete nine full courses in economics with a grade of at least C− (1.67) in each course and achieve at least a 2.00 grade-point average. These must include both intermediate theory courses, Econ 605 and 611. Students must also pass Econ 525, Introduction to Economic Statistics, or equivalent, as determined by the economics faculty. (Students may petition to substitute one 600- or higher-level administration or resource economics course for an economics elective.) Major credit toward Econ 605 and/or 611 will be awarded transfer students only if such courses have been taken at the junior level or above. Transfer students must take five of their nine

economics courses at UNH. All economics majors must satisfy the Bachelor of Arts degree requirements (page 16).
A suggested plan for economics majors is given below:

Freshman and Sophomore Years

Econ 401, 402, Principles of Economics (Macro and Micro); Econ 525, Introduction to Economic Statistics

Junior Year

Econ 605, Intermediate Microeconomic Analysis; Econ 611, Intermediate Macroeconomic Analysis

Senior Year

Economics electives (4)

Minor A minor in economics consists of Econ 401, 402; Econ 605 or 611 or 635; and two economics electives.

Hotel Administration

(For descriptions of courses, see page 144.)

The hotel administration program objective is to prepare students to perform managerial-level jobs in enterprises and institutions of the service sector, which have lodging and/or food service components. The service sector includes lodging, food service, tourism, and recreation industries, and institutions such as hospitals and schools.

The program design recognizes that in order to have a well-rounded University education, students need a course foundation in business administration and economics as well as the liberal arts. The hotel administration courses build upon such a foundation and provide experience and in-depth education specifically in the lodging and food service industries.

The program is also designed to include a mix of practical experience along with classroom activities. These practical experiences are provided in the operation of a campus food service facility, catering services, gourmet dinners, and major consulting projects to industry (as part of classroom projects), lecture series, seminars and field trips, and a required summer of related work experience.

The hotel administration program consists of 14 required courses in three groupings. Group A consists of 6 core courses taken in freshman and sophomore years. Group B includes most of the functional areas needed for developing successful management skills. These are generally taken in sophomore and junior years. Group C includes Hospitality Marketing Management and a final capstone course, Hospitality Industry Business Policy. These are usually taken in the senior year.

Students must achieve a minimum grade-point average of at least 2.00 in Group A before Group B courses may be taken. Group B courses must be completed before taking any Group C courses.

In order to graduate, students must obtain a 2.00 grade-point average in all major required courses. Graduates of this program who are qualified for and interested in further allied studies are well prepared for advanced degree programs in business or institutional administration.

A suggested plan of study is given below:

Freshman and Sophomore Years (Group A)

Econ 401, Principles of Economics Macro; Econ 402, Principles of Economics Micro; Hotl 403, Food and Beverage Management; Hotl 556, Management of Physical Structures; Admn 403, Financial Accounting; Admn 424, Business Statistics

Sophomore and Junior Years (Group B)

Hotl 618, Financial Analysis and Control; Hotl 655, Lodging Operations Management; Hotl 667, Advanced Food and Beverage Management; Admn 611, Behavior in Organizations; Admn 651, Marketing; Admn 653, Financial Management

Senior Year (Group C)

Hotl 700, Hospitality Marketing Management; Hotl 703, Hospitality Industry Business Policy

Secretarial Studies

(For descriptions of courses, see page 184.)

The Whittemore School also offers courses in secretarial studies, including introductory and advanced typing and shorthand, for all students in the University.

Special University Programs

Preprofessional Programs

Prelaw

The Prelaw Committee of the University of New Hampshire recommends consideration of the following description of prelegal education excerpted from the *Prelaw Handbook* of the Association of American Law Schools.

Law schools are vitally concerned with the quality of preparation that students bring from their undergraduate experiences. For unless that preparation has been of high quality, the law schools cannot equip them for satisfactory performance within the legal profession and the democratic community.

The Association's responsibility in matters of prelegal education cannot best be met by prescribing certain courses and extracurricular activities for students planning to study law. The wide range of a lawyer's tasks opens a correspondingly wide range for choice of relevant prelaw preparation. So-called "law" courses in undergraduate instruction should not be taken for the purpose of learning the "law." They are not likely to be effective as education for lawyers, although they can be very helpful for teaching students "about law" and quite possibly for helping students estimate whether they might be interested in law study.

But while it considers the prescription of particular courses unwise, the Association can call attention to the quality of undergraduate instruction it believes fundamental to the later attainment of legal competence. That quality of education is concerned with the development in prelaw students of basic skills and insights. It thus involves education for:

Comprehension and Expression in Words Language is the lawyer's working tool. He or she must be able, in the drafting of legal instruments, to convey meaning clearly and effectively. In oral and written advocacy he or she must be capable of communicating ideas convincingly and concisely. In reception no less than in expression, language is fundamental as the lawyer's medium of communication. For the lawyer must be able to grasp the exact meaning of factual statements and legal instruments, to catch the fine points of legal reasoning and argument, and to comprehend the technical materials that constitute the body of the law. To acquire sufficient capacity for communication calls for extensive practice in all phases of the art. Truly, the law-trained man or woman must be a precisionist in the use of the English language.

Critical Understanding of Human Institutions and Values The purpose is to develop insight into, rather than merely information about, institutions and values: human nature and the physical world; the economic systems of societies; the democratic processes in western societies; the social structures of societies; the cultural heritage of western societies, including philosophy and ethics.

Creative Power in Thinking The purpose is to develop a power to think clearly, carefully, and independently. A large part of the work law-trained people are called upon to do calls for problem solving and sound judgment. Creative power in thinking requires the development of skill in: research; fact-completeness; marshalling and differentiation of facts; deductive and inductive reasoning; reasoning by analogy; critical analysis; constructive synthesis; power of decision.

Students who hope to enter law school should contact a member of the University Prelaw Committee to discuss courses of study and other matters related to law school. This is particularly true for seniors intending to take the Law School Admission Test (LSAT) and to enter law school upon graduation. The members of the Prelaw Committee are: John R. Kayser, chairperson, Political Science; Richard V. Desrosiers, Ancient and Modern Languages and Literatures; William R. Jones, History; and Ann L. Morgan, Recreation and Parks.

Preprofessional Health Advisory Committee

Students preparing for careers in medicine, dentistry, optometry, osteopathy, podiatry, pharmacy, and physician assistant programs should become familiar with the minimum course requirements in their respective fields of interest as early as possible in order to incorporate the required courses into their college programs. There is no preprofessional major with a rigidly prescribed curriculum; rather, it is the acknowledgement of a student's professional intentions. Students are encouraged to major in subjects of their choice, either in sciences or nonsciences. In the past few years there has been a trend, particularly in premedicine and predentistry, away from exclusive concentration in a single area of science. Successful applicants from UNH have majored not only in sciences such as zoology, microbiology, biochemistry, and chemistry but also English, history, languages, psychology, and political science.

Students are assigned an appropriate faculty adviser from the department or school of their chosen major. The responsibility of the Preprofessional Health Advisory Committee is to offer information about specific admissions requirements and procedures to the professional schools desired and to provide recommendations at the time of application.

All medical and dental schools expect applicants to have demonstrated ability in basic natural and physical sciences. Although the specific requirements for admission vary considerably, the following courses constitute a minimum for students to be considered for admissions: biological sciences, physics, general chemistry, and organic chemistry—all two semesters each with laboratory; only a few schools require calculus, but it is recommended. A year of English, preferably composition, is required. An appropriate group of courses from among the offerings at the University of New Hampshire would be the following: Zool 412, 518; Phys 401-402; Chem 403-404, 651-652, 653-654; and Math 425-426. One semester of general psychology is also required by some dental schools.

Courses which qualify individuals for consideration as premedical, predental, or other preprofessional students should be completed by the time application to a professional school is submitted, usually by the end of the junior year. Inasmuch as performance in these courses is weighted heavily by the admissions committees, it is strongly recommended that students not register for them under the pass/fail grading alternative.

The following schedule is suggested for timing applications to medical and dental schools:

1. Students should apply to schools of their choice in the summer after their junior year if they wish acceptance following graduation. However, a delay of a year or more to complete courses or to work is neither detrimental nor unusual for acceptance into medical or dental school. Though the application services accept applications from June through December, early applications are often advantageous.

2. The MCAT and DAT exams are preferably taken in the spring of the student's junior year (if the student is applying as a senior). The Medical College Admissions Test (MCAT) or the Dental Admission Test (DAT) must be taken before or at the time of application to medical or dental schools.

3. Interested students should contact the Preprofessional Health Advisory Office early in their college careers and meet members of the advisory committee preceding their application to professional schools, since the letter of recommendation provided by the committee is an integral part of the admissions process. Visit the office or call 862-3625 for an appointment.

Among students from UNH who were accepted into medical and dental schools over the past five years, the competitive overall grade-point average was approximately 3.50 for medical school and 3.40 for dental school.

Interdisciplinary Programs

In addition to the general University interdisciplinary opportunities described in this section, other ways of combining studies are mentioned in the program information of the various colleges and schools. Some of the more specific opportunities are:

Biomedical systems and instrumentation minor, page 51;
Community development, page 42;
Dual degrees, page 16;
Environmental conservation, page 43;
Environmental engineering minor, page 52;
Five-year B.A.–M.B.A. program, page 22;
Five-year B.S.–M.B.A. program, page 39 and page 50;
Forest resources, page 44;
General studies, page 42;
History and philosophy of science minor, page 23;
Humanities major, page 29;
Hydrology, page 45;
Independent study and projects in the College of Engineering and Physical Sciences, page 52;
Interdisciplinary mathematics (9 options), page 62;
Interdisciplinary science—B.A., science major, chemistry concentration, page 55, earth sciences concentration, page 58, mathematics concentration, page 61, physics concentration, page 65;
International and Foreign area studies, page 24;
Linguistics major, page 30;
Materials science minor, page 51;
Minors, page 17;
Ocean engineering minor, page 51;
Oceanography minor, page 51;
Religious studies minor, page 24;
Resource economics, page 45;
Second majors, page 17;
Soil science, page 46;
Student-designed majors, page 80;
Wildlife management, page 46;
Women's studies minor, page 24.

Student-Designed Majors

Under special circumstances, students may design their own majors. This option is offered for highly motivated and independently disciplined students who seek a course of study that is not available through existing programs at the University. It allows students, with the close supervision of faculty members, to cross department and college lines and to create educational experiences on and off campus as part of individual programs of study.

Student-designed majors are administered by a committee of elected faculty that operates through the Office of the Vice President for Academic Affairs. Students who want to design their own majors are expected to give the committee evidence of careful thought and planning in a detailed proposal submitted before the middle of their junior year. Proposal guidelines are available in the Office of the Vice President for Academic Affairs.

Intercollege Courses

The Independent Work-Study courses are continuing offerings and are listed in the course descriptions, page 151.

Interdepartmental Biology Major

(For course descriptions, see page 107.)

The interdepartmental biology major is designed with a common core curriculum from which programs of study are available for: 1) preparation for teaching biology in secondary schools; and 2) preparation for professional careers in biology or graduate study. Completion of the four-year undergraduate program plus a fifth-year internship will be necessary for biology teacher certification.

Students are advised to declare the biology major as incoming freshmen to assure adequate program planning. The major is offered in both the College of Liberal Arts and the College of Life Sciences and Agriculture under the supervision of the Inter-College Biological Sciences Organization. Students who wish a less specialized program or who do not plan to teach secondary school should consider a major in animal sciences, biochemistry, botany, entomology, microbiology, plant science, or zoology.

Major and supporting courses in the following

list should be taken in the sequence given. Students planning to teach should enroll in Educ 500 during their sophomore year and should consult with the Department of Education on further courses in that field. Those not planning to teach will instead take three advanced biological science or supporting courses. Graduation requirements include a 2.00 cumulative grade-point average in the courses prescribed in the major. A grade of C− (1.67) or better is required in 11 biological science courses. Students majoring in one of the biological science departments may not minor in biology.

Students interested in the biology major should contact Robert O. Blanchard, if in the College of Life Sciences and Agriculture; Robert A. Croker, if in the College of Liberal Arts; or Abigail R. Lumsden, Department of Zoology, if planning to teach.

Major Course Sequence Note: Except for science courses, University General Education Requirements are not included. (See General Education Requirements, page 14).

Freshman Year

Bot 411 or 412, Zool 412, Chem 403-404, Math 425

Sophomore Year

Chem 545, Zool 518, Zool 519, Biol 541, Educ 500*, Bot 566

Junior Year

Phys 401-402, Bot or PlSc 606, Micr 503, education*, advanced biology, or supporting courses†

Senior Year

Ento 402, Zool or PlSc 604, a 700-level botany course, education*, advanced biology, or supporting courses†

*For teacher preparation, consult the Department of Education.

†For nonteacher preparation, substitution of Chem 651–652 for Chem 545 early in the program, and the second semester of calculus, are suggested for graduate school preparation.

Genetics

An undergraduate degree in genetics is not offered at the University of New Hampshire. In the Graduate School, the M.S. and Ph.D. degrees are offered in an interdepartmental Genetics Program. For some of the courses offered in the program, see the Genetics entry in the back of this catalog. Students interested in preparing for graduate work in genetics at UNH or elsewhere should contact the chairperson of the Genetics Program early in their undergraduate careers for advice on courses.

Nutritional Sciences

(For course descriptions, see page 165.)

Students interested in careers in the nutritional sciences complete a core of basic courses in the biological and physical sciences while taking specialized courses in nutrition. The core requirements are in chemistry, zoology, English, biochemistry, and nutritional sciences. See Nutritional Sciences, page 47.

Marine Programs

Undergraduate programs in marine science and ocean engineering at the University of New Hampshire reflect the diversity of the ocean itself and are enriched by easy access to a variety of natural laboratories, ranging from freshwater lakes to open ocean.

Faculty members in every school and college contribute to marine education, and students may choose marine-related options or minors in several departments: biochemistry, botany, chemical engineering, chemistry, civil engineering, earth sciences, electrical and computer engineering, mechanical engineering, microbiology, and zoology.

The Whittemore School of Business and Economics, the UNH Institute of Natural and Environmental Resources, and the departments of animal sciences, mathematics, computer science, physics, and physical education also offer courses that deepen students' understanding of marine issues.

An example of UNH's interdisciplinary marine curriculum is the Ocean Projects Course, in which students from any department can form project teams to work on "real world," marine-related problems in engineering; the social, biological, and physical sciences; and the humanities.

An intensive field-lab-lecture introduction to marine science is offered every summer at the Shoals Marine Laboratory on the Isles of Shoals.

Students interested in ocean studies or marine careers need a solid foundation in the basic sciences—chemistry, mathematics, and physics—and should, as freshmen, consult advisers in the department most closely allied with their field of interest.

A rich variety of marine environments, within minutes of the University of New Hampshire, enhances the facilities which support academic programs. The Great Bay estuary provides one boundary of Durham, and on it, just four miles from campus, is the Jackson Estuarine Laboratory. Also nearby are intertidal and coastal areas ranging from salt marshes to rocky shores. The Isles of Shoals, where the Shoals Marine Laboratory is located, provide an insular marine environment ten miles offshore in the Gulf of Maine.

These and other facilities are available for undergraduate use, as are UNH's research vessels. Whether students use campus or off-campus laboratories, there are ample opportunities to test theories and make firsthand observations to supplement classroom work.

For more information contact the Marine Program Office, Marine Program Building.

Marine Science Students who wish to prepare for a career in oceanography should have a good foundation in the basic sciences. As a minimum, they should elect Chem 403-404, Math 425-426, and Phys 407-408 and 505. Students should declare a major in one of the established science disciplines closest to their principal area of interest. An adviser in the department will help students select additional courses. Those students interested in chemical, geological, or physical oceanography should

consult with Herbert Tischler, Department of Earth Sciences. Students with interests in the area of biological oceanography should contact John E. Foret, Department of Zoology; Arthur C. Mathieson, Department of Botany and Plant Pathology; or Galen E. Jones, Department of Microbiology. Usually additional work at the graduate level is necessary in the field of oceanography.

Ocean Engineering The ocean engineering minor is available to undergraduate engineering students (see page 51).

Oceanography An oceanography minor is available to all UNH students. It should be considered by students who plan on taking some of the courses listed in Marine Science, in addition to courses in their academic major (see page 51).

Cooperative Field Marine Science Program at the Shoals Marine Laboratory A summer program emphasizing field marine science is offered in cooperation with Cornell University. A general introduction to marine science aimed primarily at undergraduates, the program draws on the backgrounds of more than 25 faculty members and nearly as many captains, fishermen, and others whose living is associated with the sea. Prerequisite: at least one full year of college biology. Daily lectures and laboratory fieldwork are conducted at the Shoals Marine Laboratory on Appledore Island at the Isles of Shoals. Two sections of a four-week course in Field Marine Science, Zool 674 (6 credits), are taught each summer. In addition, advanced courses are offered in Invertebrate Embryology (three weeks, 4 credits), Field Phycology (three weeks, 4 credits), Research in Biology (one to five weeks, 1 to 4 credits), Underwater Research (two weeks, 2 credits), Coastal and Oceanic Law and Policy (one week, 1 credit), Chemical Oceanography in the Field (three weeks, 4 credits), and Field Marine Science for Teachers (one week, 1 credit) and additional courses. For further information, contact Arthur C. Borror, Zoology Department, Spaulding Life Science Bldg., University of New Hampshire.

Diving Program The UNH diving program offers instruction in SCUBA diving, research diving techniques, and underwater photography, and provides professional diving support for underwater research (see pages 171, 173 and 174).

Field Experience Program

The field experience program integrates theoretical classroom study with planned and supervised practical experience. The program operates in three different patterns: full-time employment during half of the academic year, alternating a semester in class with a semester of work; part-time employment and part-time classwork during the whole academic year; and full-time employment during the summer.

Participating students are placed in off-campus positions that are related to their curricula, and these positions are of sufficient quality to provide learning experiences. The students not only strengthen their academic knowledge through practical experience but also gain greater career awareness and understanding of the business environment.

Students from the following colleges, departments, and programs may participate: College of Engineering and Physical Sciences, Whittemore School of Business and Economics, College of Liberal Arts (ancient and modern languages and literatures, geography, history, microbiology, philosophy, sociology and anthropology, theater and communication, and zoology); College of Life Sciences and Agriculture (animal sciences, biochemistry, botany, entomology, INER, and plant science); Career Option Minors; and Associate in Arts degree.

Students may earn elective credits toward graduation by registering for the appropriate DCE Field Experience course. Interested students should contact the Field Experience Program, Division of Continuing Education, Verrette House.

Reserve Officers Training Corps Programs

The Army and Air Force offer Reserve Officers Training Corps (ROTC) programs leading to a commission as a second lieutenant in their respective services. Both programs are open to men and women. Students in either ROTC program may pursue any University curriculum that leads to a baccalaureate or higher degree.

Two- and four-year programs are available. The four-year program is open to freshmen and to transfer students who began ROTC at another institution. In addition to on-campus ROTC course requirements, students must attend an officer preparatory training session for a part of one summer.

Two-year ROTC programs are open to students who have two academic years of study remaining at the University. Applicants for the two-year program must attend a six-week training session during the summer immediately before their entry into ROTC.

ROTC scholarships are offered on a competitive basis by both the Army and Air Force. Entering freshmen may compete for four-year scholarships during the last year of high school. Students in a four-year ROTC program and two-year program applicants compete for scholarships covering their remaining academic years. Scholarships pay for full tuition, all mandatory University fees, and required textbooks for all courses. In addition, all scholarship recipients receive a tax-free $100-per-month subsistence allowance. Nonscholarship students in the last two years of an ROTC program also receive the tax-free $100-per-month subsistence allowance.

Students in Air Force ROTC are required to take a math reasoning course from a list approved by the professor of aerospace studies as part of their curriculum. Students who are qualified for pilot training are provided civilian flight instruction.

More specific information about ROTC programs may be obtained by contacting the professor of military science (Army ROTC) or of aerospace studies (Air Force ROTC).

Off-Campus Programs

Consortium (NHCUC) Student Exchange Program

Under the Student Exchange Program of the New Hampshire College and University Council (NHCUC), UNH students may be eligible to enroll for: one or two courses, one semester of courses, or a full year of coursework at a member school, on a space-available basis. The purpose of the consortium exchange is to allow matriculated undergraduates to use educational resources that are not available at the home campus and are considered appropriate for their degree programs. The consortium exchange will be used only when academic reasons or other special circumstances warrant it. Approval of the UNH adviser and college dean is required. Schools in the NHCUC consortium include: Colby-Sawyer College, Daniel Webster College, Franklin Pierce College, Nathaniel Hawthorne College, New England College and its Arundel Branch in England (limited enrollment), New Hampshire College, Notre Dame College, Rivier College, St. Anselm's College, UNH, Keene State College, and Plymouth State College. Students will remain as degree candidates and continue to pay normal UNH tuition and fees but must make their own room and board arrangements if they plan to spend a full semester at another consortium school. For more information and application forms, students should contact Michael Maxey, coordinator for the Student Exchange Program, Liberal Arts Advising Center (Murkland Hall). F. William Forbes (Department of Ancient and Modern Languages and Literatures) is the University's member of the council's Cooperative Academic Programs Committee.

MVC/UNH Student Exchange Agreement

The purpose of the Merrimack Valley College/ UNH student exchange is to allow matriculated undergraduates at either institution to use educational resources which are not available at their home campus but which are available at the host campus and are considered appropriate for their degree programs. The student exchange will be used only when academic reasons or other special circumstances warrant it. UNH undergraduates interested in the student exchange must receive prior approval from Michael Maxey in the Liberal Arts Advising Center, Murkland Hall.

Foreign Study Programs

The University's Department of Ancient and Modern Languages and Literatures (AMLL) offers opportunities to study in France, Spain, and Mexico. For more information, contact AMLL, Murkland Hall. UNH offers summer programs for study abroad, in Cambridge, England, and the U.S.S.R. For information on the Cambridge program contact Robert Hapgood in the English department. For the other programs, contact AMLL.

It is also possible, with prior approval, to obtain credit from other institutions for foreign study programs. Interested students should contact Michael Maxey in the Advising Center, Murkland Hall.

New England Subdegree Exchange Program

In order to provide students at the New England land grant universities with expanded access to unique programs and faculty expertise, the institutions have agreed to encourage student exchanges of one but not more than two semesters. To qualify, a student must: identify a course or combination of courses related to the student's area of academic interest and not available on his/her home campus, be a degree candidate in good standing with at least a 2.50 grade-point average, be at least a first-semester sophomore, and receive permission from the appropriate university exchange authorities at both the sending and receiving institutions. Interested students should contact Carolyn Tacy at the Dean of Students Office, Huddleston Hall.

UNH/USA Exchange Program

The University offers one-semester or full-year exchange programs with San Diego State University and the University of North Carolina at Chapel Hill. To qualify, a student must be a full-time degree candidate with at least a 2.50 grade-point average, be at least a first-semester sophomore but no more than a first-semester senior, have declared a major, receive permission from his/her college dean and adviser, and receive permission from the exchange authorities.

The concept underlying the program is that of an educational experience in a different environment within the United States. The intent is that the students should receive the fullest experience of the new university that is possible. It is hoped that the student will develop new ways of viewing the world and expand his/her conception of our complex society.

The Exchange Program facilitates the continuity of the student's educational process through a unique policy whereby the student continues to maintain his or her status as a UNH student, even while temporarily located at another university. An important feature of this policy is that the student does not have to withdraw from school and later be readmitted as is the case with some "study abroad" programs, for example. Maintaining UNH student status also facilitates reentry into classes, dormitories, and many other dimensions of University living upon the student's return.

The Exchange Program intends that the student return to UNH to continue or complete studies. In essence, this program offers students the opportunity to experience another university as a part of their UNH education. Interested students should contact Carolyn Tacy in the Dean of Students Office, Huddleston Hall.

Associate in Arts Degree

The Associate in Arts degree gives students an opportunity to obtain a general, two-year college education, elect career-training coursework in several fields, and earn college credits in supervised work experience with cooperating employers.

The Division of Continuing Education (DCE) designed the program to be equally accessible to both full- and part-time students and, in doing so, assured that a wide range of University credit courses would be available both during the late afternoon and early evening hours and during the daytime.

For full-time A.A. students, cooperative field work can mean alternating semesters of full-time study and full-time employment (with pay) in one of several careers. For part-time students who already hold full-time positions, it can mean an opportunity for new on-the-job experiences for college credit. Each field experience is arranged by a DCE coordinator on an individual basis.

The degree can be complete in itself, or it can be a halfway mark toward a bachelor's degree. Credits earned as an A.A. degree candidate are transferable into related bachelor's degree programs at UNH and other colleges and universities.

Career Concentrations

Within the Associate in Arts degree program, students may elect courses in one or more of the following concentrations:

Accounting Accounting is one of the largest office professions in the United States today. Increasing government regulations—ranging from new tax laws to wage and price controls—require the expertise of a greater number of qualified accountants and auditors. This career concentration provides students with the degree of specialization required to qualify for responsible jobs in accounting and will aid them in pursuing a more advanced degree at a later time in their careers. Required accounting courses: DCE 462-463, 561, and 562.

Computer Information Studies Computer information specialists are essential personnel in today's technological, information-oriented society. This career concentration trains men and women for such entry-level positions as data analyst, programmer, computer applications technician, and computer operations supervisor. Furthermore, the course of study will provide sufficient foundation for graduates with subsequent experience and continued training to advance in any of a wide variety of career paths appropriate to their particular interests and abilities.

Required computer information studies courses: CS 410, 410C, and DCE 490, 590, 591, and 592.

Criminal Justice Careers in criminal justice are among the most challenging occupations for men and women today. Careers in criminal justice extend beyond the "police beat" and include, for example, positions in various agencies of law enforcement at the municipal, county, state, and federal levels of government, and in private industry. Required criminal justice courses: DCE 550, 551, and 552, and a choice either of one from DCE 554, Polt 507, or Soc 615.

Library and Information Services Through basic courses in library services, this program trains paraprofessional librarians. Employment opportunities exist in public school and college libraries, as well as in specialized libraries maintained by commercial and industrial firms, government agencies, and other organizations and institutions. Required library science courses: DCE 401, 402, and 403; and one from 501, 502, or 503.

Management Careers in management exist at many levels, and this career concentration is designed to assist students in gaining entry and promotional opportunities in the field. The career-training coursework emphasizes and develops the skills needed in management functions. Competent personnel at the assistant managerial level will continue to be needed for business, sales, purchasing, personnel, accounting, and public relations, to name a few. Individuals now planning or running their own businesses will also find the practical nature of this career option quite helpful. Required courses for the *small business management* emphasis: DCE 430; DCE 431; and two from DCE 411, 432 (or 462), 532, or 534. Required courses for the *manufacturing management* emphasis: DCE 430; DCE 431; and two from DCE 432 (or 462), 480, or 570. Required courses for the *general management* emphasis, recommended for students without business experience: DCE 430; DCE 431; and two from DCE 432 (or 462), 530, or 532. Required courses for the *office administration* emphasis: DCE 430; DCE 431; and eight credits from DCE 432 (or 462), DCE 535, Secr 401-402, or Secr 407-408.

Merchandising Careers in merchandising represent a significant segment of New Hampshire's economy, and many functions within the field require specific knowledge and skills. The career-training coursework in merchandising begins with the fundamentals and expands to specific techniques in promotion and advertising, retailing, and credit management. Employment opportunities exist not only in large industries but also in department stores, retail operations, discount stores, supermarkets, mail order operations, and smaller variety stores in the resort areas. Required merchandising courses: DCE 410, 411, 510, and either 512 or 533.

Real Estate The career training coursework in the real estate concentration can help students who wish to qualify for a state license. A.A. graduates who concentrate on the real estate concentration may often find a higher-level job entry and increased promotional opportunities with both large and small real estate firms. Supplemented with elective courses in management, this concentration can also offer a solid educational background for individuals planning to establish businesses. Required real estate courses: DCE 425, 426, 525, and 526.

Admission Requirements

For the Associate in Arts degree program, candidates must have a high school diploma or an equivalency certificate and should have demonstrated ability and motivation through secondary school achievement, work experience, and/or military service. Because of the present limited residence hall capacity of the University, this program is available only to commuting students.

Associate in Arts degree candidates are awarded a minimum of 64 credit hours upon entry into a UNH bachelor's degree program. Degree candidates wishing to continue their studies should consult with their advisers to assure that their planned programs meet the specific requirements for the selected major at the institution awarding the bachelor's degree.

Applications for admission may be obtained from the Division of Continuing Education. After being admitted to the A.A. degree program, candidates will be referred to a permanent adviser in the DCE Office of Academic Advising.

Degree Requirements

For degree requirements, see page 16.

Academic Regulations

Associate in Arts degree candidates are subject to the academic requirements established by the University.

Pass/Fail Associate in Arts degree candidates, after completion of a minimum of 16 credits at the University of New Hampshire on a regular graded basis of A to F, may use the pass/fail grading alternative in a maximum of two elective four-credit courses. The pass/fail grading alternative may be used for a maximum of four credits per semester. No pass/fail grading alternative may be used in any of the group requirements; i.e., science-mathematics, arts-humanities, and social sciences. The pass/fail grading alternative may not be used for Engl 401 or for courses in students' declared career options. The minimum passing grade for credit is a D− (0.67).

Advising

Program planning and other advising services are provided by the professional staff of the Division of Continuing Education. Academic advisers are available from 8 a.m. to 4:30 p.m. daily and during evening hours on an appointment basis.

Financial Aid

Associate in Arts degree candidates are eligible for the full range of financial aid offered by the University. See the Financial Aid section of this catalog.

For More Information

For further information about programs or services, write or visit the Division of Continuing Education, Office of Academic Advising, Verrette House, UNH, Durham, N.H. 03824 (603) 862-1548.

Thompson School of Applied Science

Lewis Roberts, Jr., Director

The mission of the Thompson School of Applied Science (TSAS) is to offer two-year, technical-level programs leading to an Associate in Applied Science degree. A "learning-by-doing" educational approach prepares graduates for employment as technicians, professional assistants, supervisors, and mid-management personnel in industry, organizations, and agencies.

Programs currently offered include: 1) Applied Animal Science, 2) Applied Business Management, 3) Civil Technology, 4) Food Services Management, 5) Forest Technology, and 6) Horticultural Technology.

Thompson School graduates acquire necessary skills and experience to seek satisfactory employment at the end of two years; they also have the option to continue their education at the baccalaureate level.

Thompson School students are eligible for on-campus housing.

Admission Requirements

Applicants to the Thompson School of Applied Science are considered on the basis of secondary school course selections, academic achievement, class rank, and school recommendations. The secondary school program need not be college preparatory. Rather, emphasis is placed on applicants' motivation and demonstrated interest in their career fields.

All candidates graduating from high school must submit the results of the College Entrance Examination Board Scholastic Aptitude Test. Applicants to the Forest and Civil Technology programs must also have completed two years of satisfactory work in college preparatory mathematics.

Financial Aid

Associate in Applied Science degree candidates are eligible for the full range of financial aid offered by the University. See the Financial Aid section of the Thompson School catalog.

Advising

Program planning and other advising services are provided by the faculty and professional staff of the Thompson School. Academic advisers are available during office hours or on an appointment basis.

Transfer Policy

Many colleges accept Thompson School graduates at the junior-year level. Others, including most UNH baccalaureate programs, accept Thompson School graduates as second-semester sophomores.

The University awards partial credit transfer for TSAS course work. Students who seek to continue their education in the University's baccalaureate degree programs are advised that transfer consideration is based on an applicant's level of achievement and on the availability of spaces in the baccalaureate programs. Students with an academic average of 2.80 or higher at the end of the freshman year, or 2.50 or higher at the end of the senior year, may be eligible for transfer.

Four-hundred-plus numbered courses taken by a TSAS student will be incorporated into the cumulative grade-point average upon the student's matriculation in an Associate in Arts or bachelor's degree program. It applies whether or not the former TSAS student actually received the A.A.S. degree. Students may not petition to selectively include in or exclude from their Associate in Arts or bachelor's degree grade-point average any 400-plus numbered courses that were taken during the A.A.S. degree program. Interested students should check with their advisers concerning transfer.

For More Information

For a Thompson School Catalog and/or more specific information, write or call the director, Thompson School of Applied Science, Barton Hall, Durham, N.H. 03824 (603) 862-1025.

Division of Continuing Education and Summer Session

Continuing Education

Edward J. Durnall, Director
Paul A. Dubois, Associate Director

The Division of Continuing Education (DCE) provides access to higher education for New Hampshire residents under conditions that permit individuals to participate in University programs appropriate to their changing educational needs. These needs may at times be best satisfied through participation in workshops, seminars, short courses, or certificate programs—at other times by enrollment in credit courses and degree programs.

The faculty of the Division of Continuing Education is drawn from the teaching staffs of the University, from the faculties of neighboring colleges and universities, and from business, professional, and community leaders.

In addition to the programs listed below, it is possible to complete many of the degree requirements in other areas of study offered by the University through enrollment in credit courses scheduled by DCE each semester.

Associate in Arts Degree

(See page 16. For descriptions of courses, see page 117.)

Special Student Status

Special students—those who are not formally admitted into a degree program at the University of New Hampshire—may enroll in University credit courses each semester through the Division of Continuing Education.

All special undergraduate students are limited to 11 credits per term unless they obtain written permission from the director of admissions, Thompson Hall. Special graduate students are also subject to enrollment limitations. Contact the Division of Continuing Education for details.

Undergraduate Courses Special students must have a high school diploma or its equivalent or be at least 18 years of age.

Graduate Courses Special students must hold a bachelor's degree or equivalent from an approved college or university.

Prerequisites All students are responsible for satisfying course prerequisites, if any. Instructors may require students to withdraw from a course if they are not adequately prepared for the level of work.

Academic Standards A cumulative grade-point average of 2.00 (C grade) is the minimum acceptable level for undergraduate work in the University. The Division of Continuing Education Executive Committee examines the records of special undergraduate students periodically and may warn academically deficient or potentially deficient students, or may exclude or suspend those who are academically deficient.

Diploma Programs

To meet the need for University-quality, short-term, career-related programs for adults, the division has developed career concentration diplomas in accounting, computer information studies, criminal justice, general management, industrial management, library and information services, merchandising, office administration, and small business management.

Each diploma program consists of four or five credit courses which concentrate on a specific career area. These required courses can normally be completed in two or four semesters of part-time study. Upon successful completion of the required courses, students will be awarded a diploma from the Division of Continuing Education, and the students will have a permanent record of their achievements on file with the University.

For application forms and further information, contact DCE Academic Advising, Verrette House, 862-1548.

Noncredit Courses

Throughout the year, DCE offers noncredit courses to the community. These courses provide opportunities for individual growth or continuing education for groups and individuals in business, labor, education, government, or the professions.

Professional and career development noncredit courses typically meet one evening a week for about 10 weeks, depending on course objectives. Examples include paralegal studies, business writing, information systems, graphic arts, interior design, skills for teaching, and labor-management relations.

Personal enrichment courses are offered during the day and evening, during the week, and on weekends. Examples include physical fitness and recreation, parent-child communication, arts and crafts, local history, current events, personal financial planning, creative writing, and photography.

Noncredit Certificate Programs

Certificate programs consist of specifically developed sequences of courses which provide a sound balance of theory, fundamentals, and specialized training. Certificates of achievement awarded by the Division of Continuing Education have earned professional acceptance as evidence of increased knowledge in basic principles and techniques.

Noncredit certificate programs include interior design, graphic arts, gerontology, applied farm technology, calligraphy, illustration, and paralegal studies.

Conferences and Workshops

The division also conducts conferences, workshops, and seminars, which range from half-day briefings on specific topics to residential institutes lasting several days or weeks. Such programs are offered on topics of community interest and for the continuing education of business, industry, government, and the professions.

The division uses the facilities of the entire University campus for its programs, as well as the New

England Center for Continuing Education (adjacent to the UNH campus) and other nearby commercial establishments.

Summer Session

Please see below.

Course Charges

Students who enroll in credit courses through the Division of Continuing Education pay on a per-credit basis, depending on residency status and course level. These course charges are listed in the DCE credit course schedule published before each semester. The course charges for noncredit courses and for conferences, workshops, and institutes vary according to the scope of the individual programs.

Financial Aid

Course Charge Grants Special students (nondegree candidates) who enroll in the Division of Continuing Education may be considered for grants in varying amounts, awarded on the basis of financial need and only for course charges in credit courses and approved noncredit programs offered through DCE. Preference will be given to New Hampshire residents. Application for course-charge assistance must be filed with the Divison of Continuing Education at least one month before the start of classes for each term for which assistance is requested. Application forms are available from the DCE office.

Class Schedule

While students may enroll in morning and afternoon classes through the division, many courses offered each semester are scheduled in the late afternoon and early evening to accommodate evening students.

All courses offered by the University each semester are open to special students on a space-available basis. However, because UNH degree candidates have first priority in many classes, special students may not be assured space in certain classes until the first class meeting.

Division Publications

Specific information on course offerings, registration procedures, and academic requirements can be found in individual publications describing each program. For more information, write: Division of Continuing Education, 6 Garrison Avenue, UNH, Durham, N.H. 03824 (603) 862-2015.

Summer Session

Edward J. Durnall, Director

The University of New Hampshire offers students the opportunity to continue their studies on a year-round basis through four- and eight-week sessions during the summer months. The summer courses are of the same high quality as those during the regular academic year and require the same level of academic performance.

Summer Session offerings include a full range of undergraduate and graduate credit courses in most of the major academic disciplines. Throughout the summer, classes are scheduled in the morning, afternoon, and evening.

Enrollment in Summer Session classes does not imply admission to degree candidacy.

Undergraduate Courses

Undergraduate courses are open to college undergraduates, to interested members of the community who have a high school diploma or its equivalent or who are at least 18 years of age, and to high school students completing their junior or senior year (by permission of the director).

Graduate Courses

Graduate courses are open to graduate students and other individuals with a bachelor's degree or its equivalent from an approved college or university.

Other Offerings

Other Summer Session offerings include noncredit courses and certificate programs; workshops and seminars for business, industry, and the professions; and residential conferences and academic programs.

For More Information

A separate summer bulletin is published each year in March and is available from: Division of Continuing Education, 6 Garrison Avenue, University of New Hampshire, Durham, N.H. 03824 (603) 862-2015.

Graduate School

Raymond L. Erickson, Dean
William H. Drew, Associate Dean
Harry J. Richards, Assistant Dean

Master of Arts
Counseling
Economics
English
  Literature
  Language and Linguistics
  Writing
History
Music
Political Science
Psychology
Sociology
Spanish

Master of Science
Animal Sciences
Biochemistry
Biology
Botany
Chemical Engineering
Chemistry
Civil Engineering
Communication Disorders
Computer Science
Earth Sciences
  Geology
  Oceanography
Electrical Engineering
Entomology
Family and Consumer Studies
Genetics
Mathematics
Mechanical Engineering
Microbiology
Music Education
Natural and Environmental Resources
  Forest Resources
  Hydrology
  Resource Administration and Management
  Resource Economics
  Soil Science
  Wildlife Ecology
Physical Education
Physics
Plant Science
Zoology

Master of Arts in Teaching
  Elementary Education
  Secondary Education

Master of Science for Teachers
Chemistry
English
Mathematics
Physics

Master of Education
Administration and Supervision
Counseling
Developmental Disabilities
Early Childhood
  Special Needs
Elementary Education
Reading
Secondary Education

Master of Occupational Education

Master of Business Administration

Master of Public Administration

Certificate of Advanced Graduate Study
Counseling
Educational Administration and Supervision

Doctor of Philosophy
Biochemistry
  Nutrition
Botany
Chemistry
Earth Sciences
  Geology
  Oceanography
Economics
  Organizational Behavior/Labor
Engineering
  Signal Processing
  Transport Phenomena
  System Design
  Theoretical and Applied Mechanics
English
Genetics
History
Mathematics
Mathematics Education
Microbiology
Physics
Plant Science
Psychology
Sociology
Zoology

Graduate School

The Graduate School offers a wide range of programs leading to the master's degree, two programs leading to the C.A.G.S., and a number of programs leading to the Ph.D. degree. Graduate programs have been developed systematically to achieve academic excellence by careful utilization of institutional resources and regional opportunities. A highly qualified graduate faculty supervises programs and establishes the requirements for admission and degrees, which are administered by the dean of the Graduate School.

Most graduate programs are relatively small and permit students to work closely with faculty members in the area of specialization. The aim of graduate programs is to offer high-level professional training in their respective disciplines and to provide opportunities for students to learn and practice sound research methods. Graduate students are expected to use fully the available opportunities and to demonstrate the maturity and self-discipline necessary for sound scholarship.

Admission Graduate School admission may be granted to graduates of colleges and universities of approved standing, provided that applicants' undergraduate records are satisfactory.

Applications for admission and the Graduate Catalog containing detailed descriptions of graduate programs may be obtained from the Graduate School, Horton Social Science Center, UNH, Durham, New Hampshire 03824.

Early Admission—University of New Hampshire Seniors Qualified senior students at the University of New Hampshire may be admitted to the Graduate School provided they have followed normal application procedures; they must have been admitted for the semester in which they wish to enroll in courses for graduate credit. A 3.20 cumulative grade point average is normally required to be considered for early admission. Such seniors are normally admitted prior to the start of their last undergraduate semester. Seniors who have been admitted under early admission may register for a maximum of two courses for graduate credit.

Dual Credit—UNH Seniors University of New Hampshire seniors who have been admitted to the Graduate School under early admission may, upon recommendation of the department and approval of the Graduate School, be allowed, for a maximum of two 800-level courses, to count credits toward both a bachelor's and master's degree. Dual credit forms must be completed and approved by the dean of the Graduate School at the beginning of the semester for which dual credit is sought. Dual credit forms are available at the Graduate School.

All 800-level courses are offered for graduate credit only and therefore only open to admitted or special graduate students.

Financial Assistance Graduate assistantships are available in most departments. These involve part-time work in connection with the University's instructional or research activities. University awards, such as tuition scholarships, are also available to qualified students. Assistantships and scholarships are awarded on the basis of academic qualifications.

Financial assistance in the form of College Work-Study and loans may be available through the Financial Aid Office.

Description of Courses

Explanation of Arrangement

The title and arabic number designate the particular course. When two course numbers precede a course title and are connected by a hyphen, the first semester of the course, or its equivalent, is a prerequisite to the second semester. If the course numbers are separated by a comma, qualified students may take the second semester without having had the first.

In courses that are not designated by title as laboratory courses, the notation "Lab" indicates that laboratory sessions are a part of the course.

Prerequisites and Corequisites

Each prerequisite for a course is separated from the other prerequisites by a semicolon; e.g., Prereq: Educ 601; Psyc 635. If permission (of the instructor, department, adviser, or committee) is a prerequisite for all students, it is listed among the prerequisites; e.g., Prereq: Educ 601; Psyc 635; permission. If, on the other hand, permission may be substituted for one or more of the listed prerequisites, it follows the other prerequisites and is separated from them by a slash mark; e.g., Prereq: Educ 601; Psyc 635;/or permission. If permission may be substituted for only one of the prerequisite courses, it is listed with the course for which it may be substituted; e.g., Prereq: Educ 601 or permission; Psyc 635.

Corequisites are courses that must be taken in the same semester.

Credits

The number of credits listed is the number of semester credits each course number will count toward graduation (except in the case of variable credit courses). Students must register for the number of credits shown or, if the course is variable credit, must register within the range of credits shown.

Cr/F following the description indicates that no letter grade is given but that the course is graded Credit or Fail.

For up-to-date information about when a course is offered; who teaches the course; the number of recitations, lectures, labs, and such, students are referred to each semester's *Time and Room Schedule*, which carries a complete schedule of course offerings for the semester.

The system of numeric designation is as follows:

200–299	Courses in Thompson School of Applied Science.* Full credit only to TSAS degree candidates, who may transfer partial credit toward other asssociate and baccalaureate degrees.
300–399	Noncredit courses, e.g., Engl 301.
400–499	Introductory courses not carrying prerequisites and courses generally falling within University and college requirements.
500–599	Intermediate-level courses for undergraduate credit only.
600–699	Advanced-level undergraduate courses. Entrance to courses numbered 600 and above normally requires junior standing.
700–799	Advanced-level undergraduate courses. Ordinarily not open to freshmen and sophomores.
800–899	Courses which carry graduate credit only and therefore are open only to admitted or special graduate students.

*Course descriptions found in TSAS bulletin. UNH baccalaureate or Associate in Arts degree candidates may take 200-level courses for audit only, as the courses carry no graduation credits.

Administration (Admn)

(For program description, see page 77)

PROFESSORS: Robert F. Barlow, Stephen L. Fink, Russell I. Haley, James O. Horrigan, Manley R. Irwin, John J. Korbel, Dwight R. Ladd, Barry Shore, Linda G. Sprague, William E. Wetzel, Jr., Robin D. Willits, Dwayne E. Wrightsman
ASSOCIATE PROFESSORS: John M. Burt, Jr., Richard W. Hurd, Fred R. Kaen, Richard C. Martin-Diaz, Richard L. Mills, Robert C. Puth, Melvin Sandler, Starr F. Schlobohm, Allen R. Thompson
ASSISTANT PROFESSORS: Ahmad Etebari, Francine S. Hall, Michael E. Kole, Duncan G. LaBay, Michael J. Merenda, Merwin R. Sands, Rita Weathersby
FACULTY IN RESIDENCE: Katherine Cox, Nancy L. Hansen, Robert B. Mitchell, Richard J. Sebastian, Kenneth W. Wadoski
LECTURERS: Ruth Broderick, Clyde R. Coolidge, Charles B. Dethier, Joseph Michael
ADJUNCT PROFESSORS: John A. Beckett, R. Stephen Jenks, Donald Marschner
ADJUNCT ASSOCIATE PROFESSOR: Dale G. Broderick
VISITING PROFESSOR: Harry J. Waters
VISITING ASSISTANT PROFESSOR: Richard Lamb

403. FINANCIAL ACCOUNTING

Concepts, procedures, and tools of analysis in selection, quantification, and communication of economic events affecting financial condition, income, and cash flows of organizations. (Not open to students who have had DCE 462-463.) 4 cr.

424. BUSINESS STATISTICS

Introductory coverage of statistical methods for managerial decision making: probability, descriptive and inferential statistics, and regression. Quantitative techniques common to many introductory statistics courses are covered, but the emphasis is on understanding concepts such as uncertainty, inferences from sample data, and model formulation, and on utilizing these techniques as aids in decision making. 4 cr.

425. APPLICATIONS IN QUANTITATIVE ANALYSIS

The use and misuse of basic analytic skills in administration and economics; methodology and techniques introduced in Admn 424 applied to analysis and interpretation of real-world data. Case studies, student projects, and problems from the media. Prereq: Admn 424 or equivalent. 4 cr.

503. MANAGERIAL ACCOUNTING AND MANAGEMENT INFORMATION SYSTEMS

The managerial accounting portion of the course covers planning, budgeting, and control. It emphasizes introductory cost measurement, analysis, and use in decision making. The MIS portion of the course will cover introductory data processing and computer use for business. A computer-based managerial accounting game is used. Some basic programming will be taught. 4 cr.

517. SURVEY OF BASIC ACCOUNTING

Concepts, conventions, and processes in financial and cost accounting. Usefulness and limitations of accounting data in decision making and in analyses of past results. (For non-Admn majors. Not open to students who have had DCE 462-463. No credit for students who have had Admn 403.) 4 cr.

524. QUANTITATIVE MODELS FOR MANAGEMENT

Introduction to management science models used most in business: decision theory, linear programming and distribution models, forecasting and time series analysis, Markov chains. Emphasis on application and utility of these models rather than on underlying mathematical theory. Problem formulation, data requirements, model assumptions, interpretation of results, sensitivity analysis. A decision-making and problem-solving theme runs throughout the course. Prereq: Admn 424. 4 cr.

526. INTRODUCTION TO BUSINESS DATA PROCESSING

Fundamentals of data processing with applications to the functional areas of management. Topics include system design, software, hardware, and applications. Prereq: Admn 424. 4 cr.

530. PERSONAL FINANCE AND INVESTMENT

Principles and practices of personal finance and investment. Investments in real estate, stocks and bonds, money-market instruments, savings accounts, and insurance and retirement plans. Personal saving, mortgages, consumer credit, and other means of financing investments. No credit toward a major in administration. 4 cr.

550. SURVEY OF MARKETING

Same material as Admn 651, but more general viewpoint. How companies plan products, pricing, advertising, promotion, distribution. Marketing of services. Consumer behavior. Consumerism. Not for students planning to major in administration. Prereq: Econ 402 or permission. No credit for students who have had Admn 651. 4 cr.

602. VALUES IN A MANAGERIAL SOCIETY

The role and influence of values on management decision making. The conflict between traditional values such as material progress, private property, self-interest, etc., and emerging notions about environmentalism, consumerism, worker and product safety, etc. is examined through case discussions and readings. Prereq: Admn major or permission. 4 cr.

611. BEHAVIOR IN ORGANIZATIONS

Application of behavioral science concepts at work. Individual behavior, interpersonal relations, small groups, relations between groups, organization structure. Class treated as an organization; students study own roles, norms, rewards, and leadership, and take responsibility for the effects of their behavior on learning. Prereq: all Group A courses or permission. 4 cr.

614. ORGANIZATIONAL THEORY

Characteristics of formal organizations. Theory and concepts useful for analysis and administration of various types: business, educational, medical, social. Case discussions, class exercises, fieldwork. Prereq: Admn 611 or permission. 4 cr.

626. ADVANCED COMPUTER SYSTEMS ANALYSIS AND DESIGN

Analysis and design of computer systems in administration. Applications in finance, accounting, marketing, and manufacturing. Case studies and projects. Prereq: Admn 526. 4 cr.

647-648. BUSINESS LAW I, II
Law of contracts, agency, sales, negotiable instruments, real and personal property, partnership and corporations, with application of the Uniform Commercial Code. Prereq: at least junior status; permission. 4 cr.

650. OPERATIONS MANAGEMENT
Analysis of operational problems in the product and service sectors; standards, capacity, inventory, scheduling, and control. Prereq: all Group A courses; /or permission. 4 cr.

651. MARKETING
Marketing behavior of the firm as it supplies goods and services to consumers and industrial users. Optimal blending of ingredients in the "marketing mix": product pricing, promotion, preliminary consumer behavior, marketing research, and selection of distribution channels. Prereq: all Group A courses; /or permission. 4 cr.

653. FINANCIAL MANAGEMENT
The firm's uses and sources of funds; working-capital management; capital budgeting; and administration of debt and equity. Prereq: all Group A courses; /or permission. 4 cr.

661. MANAGERIAL THINKING
Thinking processes that underlie management and administration; survey of human thought, history of management thought, and prevailing contemporary models of the management process. Suitable background for all upper-division administration courses. 4 cr.

695-696. INDEPENDENT STUDY
Individual research projects that are student designed. Initial sponsorship of a business administration faculty member must be obtained, and approval of WSBE adviser and dean. For upperclassmen in high standing. 1-12 cr.

698. TOPICS IN ADMINISTRATION
Special topics; may be repeated. Prereq: permission. 4 cr.

701. BUSINESS AND ITS ENVIRONMENT
Managerial problem solving relative to the ethical, economic, social, political, and technical aspects of an organization's environment. Prereq: all courses in Group A and Group B. 4 cr.

702. APPLIED STATISTICS
Time series and cross-sectioned data; regression analysis; computerized statistical packages. Experimental design; surveys; contingency and analysis. Prereq: Admn 801 or basic statistics; permission. 4 cr.

703. BUSINESS POLICY
Capstone course, interrelating and applying specialized courses; cases of companies, firms, supplemented by economic and other information from published industry, company, and other sources. Prereq: all courses in Group A and Group B. 4 cr.

705. OPERATIONS RESEARCH
Synthesis and analysis of basic principles and methods of operations research applied to managerial decisions. Mathematical programming, networks, inventory, queuing, sequencing, scheduling, and Markovian models. Prereq: permission. 4 cr.

706. ADVANCED OPERATIONS RESEARCH
Analysis and synthesis of complex operations research models. Project is undertaken by all students. Advanced mathematical programming (nonlinear, parametric linear, stochastic, and dynamic), stochastic inventory models, advanced queuing models, and heuristic programs. Prereq: Admn 705 or permission. 4 cr.

708. MODELING AND SIMULATION
Modeling: formulation, data preparation, translation, validation, interpretation, and implementation. Discrete simulation models are developed and applied using a special purpose simulation language. Prereq: Admn 801 and 810 or basic probability and statistics; permission. 4 cr.

712. ORGANIZATIONAL CHANGE
Process of change in organizations. Change strategies; the change agent's role and relation to the client system. Bases of resistance to change and problems encountered by internal and external change agents. Theoretical reading material, cases, and exercises. Prereq: permission. 4 cr.

713. INTERPERSONAL AND GROUP DYNAMICS
Dynamics of small groups through the use of the class itself as an intensive laboratory study group. Students examine their own behavior and its effects on others through the use of the Laboratory Training Group (T-group), and develop conceptual ability and behavioral skills. Readings in group dynamics, interpersonal relations, and sensitivity training. Prereq: permission. Lab fee. 4 cr.

714. CONFLICT MANAGEMENT
Conflict among individuals, small groups, and organizations. Analysis of cases, readings, simulations, and roleplays (often using video tape) develops useful concepts and skills for dealing with conflict. Students examine their own behavior in coping with conflicts within the class. Field project required. Prereq: permission. 4 cr.

715. THEORY AND PRACTICE OF GROUP LEADERSHIP
Intensive comparison of and practice in leading task- and process-oriented groups. Student teams design presentations on leadership topics, then study their own leadership-membership issues. Each student also participates in and leads a process-oriented group. Prereq: Admn 713 or equivalent; permission. 4 cr.

717. ADVANCED FINANCIAL ACCOUNTING
Theory and practice as they contribute to the significance and limitations of the financial statements. Prereq: permission. 4 cr.

718. COST AND MANAGEMENT
Effective use of cost accounting, cost analysis, and budgeting in planning and controlling operations. Analysis of cost behavior, direct and absorption costing, cost-price-volume relationship, distribution costs, transfer pricing, and capital budgeting analysis. Prereq: permission. 4 cr.

720. AUDITING
The attest function, and the responsibility and professional ethics of the independent auditor in our society. Audit concepts, procedures, objectives,

and reports. Operational audits, social audits, and management services. Prereq: Admn 717 or permission. 4 cr.

722. TOPICS IN ACCOUNTING
Special topics. Prereq: Admn 717 or 718, depending on topics; permission. 4 cr.

723. TOPICS IN FINANCE
Prereq: Admn 653 or 806. 4 cr.

724. ADVANCED TOPICS IN OPERATIONS MANAGEMENT
Analysis and development of planning and control systems for the operations within an organization. Prereq: permission. 4 cr.

728. STATISTICAL DECISION MAKING
Probability and statistics applied to decision problems. Bayesian approach to decisions under uncertainty, which explicitly injects prior judgements of decision makers and the consequences of alternative actions. Prereq: Admn 424 or equivalent. 4 cr.

730. INVESTMENTS ANALYSIS
Capital market patterns and techniques useful for security analysis. Securities, market institutions, yield series, random walks, intrinsic-value analyses, and portfolio management. Security analysis research projects. Prereq: permission. 4 cr.

732. EXPLORATION IN ENTREPRENEURIAL MANAGEMENT
Examination of the management of change and innovation with particular attention to the role of the entrepreneur in the management of new ventures. Characteristic behavioral, organizational, financial, and marketing problems of entrepreneurs and new enterprises. Prereq: permission. 4 cr.

741. TRANSPORTATION
Problems of American transportation system. Economic structure of transportation industries; competition among the several modes. Public policy questions: merger, cost-benefit analysis of facilities, for example. Freight transportation; problems of passenger transportation, especially in urban areas. Prereq: permission. 4 cr.

742. MANAGEMENT INFORMATION SYSTEMS
Concepts, design, and implementation of systems to provide information and support for managerial decision making. Use of computers, models, and behavioral factors from the manager's perspective. Prereq: upperclassmen only. 4 cr.

745. INTERNATIONAL BUSINESS
Issues and problems confronting managers in the international economy. Emphasis on problems of working across national borders rather than on those encountered within the framework of different national economies, cultures, and institutions. For managers working in a multinational enterprise. Prereq: permission. 4 cr.

747. FEDERAL TAXATION
Current federal income, estate, and gift taxes and their impact on corporations, partnerships, and individuals. Tax analysis and decision making. Prereq: upperclassmen only. 4 cr.

750. MARKETING MANAGEMENT
Practical application of theories taught in Admn 651. Planning, organization, and control of marketing activities in large corporations and small businesses; new-product development; pricing policies; selection of channels of distribution; interrelationships between marketing, production, and finance. Sound policy formulation and decision making established through analysis of cases and computer simulation. Prereq: a basic marketing course. 4 cr.

751. ADVERTISING AND PROMOTION
Advertising, personal selling, and other promotional tools to help solve marketing problems; advertising as a medium of communication and as a social-cultural force in the Western world. Prereq: Admn 651; /or permission. 4 cr.

752. MARKETING RESEARCH
Identification, collection, and analysis of data for the marketing process. Strengths, limitation, environment, and evaluation of research in the marketing process. Prereq: Admn 651; /or equivalent. 4 cr.

755. ADVANCED BUSINESS FINANCE
Development of analytical tools and practical skills for recognizing and solving complex problems of business finance. Working-capital management, capital budgeting, cost of capital, capital structure, and dividend policy. Prereq: Admn 653 or 806. 4 cr.

756. MANAGEMENT OF FINANCIAL INSTITUTIONS
How financial institutions manage their sources and uses of funds; impact of external environmental factors upon the operation and performance of financial institutions. Optimal portfolio strategies for commercial banks, savings and loan associations, mutual savings banks, insurance companies, and pension funds. Implications of monetary theory for individual financial institution policies; credit analysis; competition among financial institutions; regulation of financial institutions. Prereq: Admn 653 or 806. 4 cr.

761. SALES MANAGEMENT
Principles and methods of successful salesmanship and management of the sales function. Selling experiences in fields of student interest; case studies, sales presentations; oral and written analyses of sales management issues. Prereq: Admn 651. 4 cr.

762. MARKETING WORKSHOP
Integrative study of a real marketing situation in a business, nonprofit institution, or government agency. Student teams identify problem, research or collect data, suggest alternate solutions, and submit a recommended course of action. Prereq: Admn 651 or Admn 808; one additional advanced marketing course; permission. 4 cr.

770. PERSONNEL ADMINISTRATION
Role of personnel administration and human resource management in achieving goals in "for-profit" and "not-for-profit" organizations. Functions of management; scope, technique, and current issues of personnel administration; organization of personnel activities and staff. How managers relate to personnel administration and interact with personnel administration staff and services. Prereq: permission. 4 cr.

780. WOMEN IN MANAGEMENT
Issues faced by women managers in complex organizations; problems associated with role expectations of women as they move into managerial positions traditionally filled by men. Prereq: senior or graduate standing. 4 cr.

795. INTERNSHIP
On-the-job skill development through fieldwork in an organization (business, industry, health, public service, etc.). Normally, supervision provided by qualified individual in the organization, with frequent consultation by a faculty sponsor. Written report required. Internships may be part- or full-time, with course credits assigned accordingly. 1-16 cr.

798. TOPICS IN ADMINISTRATION
Special topics; may be repeated. Prereq: consent of adviser and instructor. 1-4 cr.

Aerospace Studies (Aero), Reserve Officers Training Corps

(For program description, see page 82)

PROFESSOR OF AEROSPACE STUDIES: Col. David S. Penniman
ASSISTANT PROFESSOR: Capt. Eddylou Donovan, Major Bobby Roberts
STAFF: TSgt Lionel R. Beaulieu, Jeanette K. Carignan, SSgt John Gaudet, Sgt Joan K. O'Neil

Leadership Laboratory is required each semester of all Air Force ROTC students seeking commissions as second lieutenants in the U.S. Air Force upon graduation. Students taking Air Force ROTC courses for credit, but not seeking commissions, need not register for this lab.

301. LEADERSHIP LABORATORY
Taken by all AFROTC cadets throughout enrollment in AFROTC. Command and staff leadership experiences in cadet corps. Air Force customs and courtesies; drill and ceremonies; career opportunities; life and work of junior officer. Student leadership potential developed in a practical, supervised laboratory. Field trips to Air Force installations. 0 cr.

415. THE AIR FORCE TODAY I
Development, mission, and organization of the Air Force as an instrument of the U.S. national defense policy. 1 cr.

416. THE AIR FORCE TODAY II
Major Air Force commands; roles of separate operating agencies; organization, systems, and operations of strategic defense; general-purpose aerospace support forces. 1 cr.

541. THE DEVELOPMENT OF AIR POWER I
The nature of warfare; development of air power from balloons and dirigibles through World War II. 1 cr.

542. THE DEVELOPMENT OF AIR POWER II
Development of air power from post-World War II through the peaceful use of air power in Berlin; the Cuban crisis; air war in Southeast Asia; and research and development of present and future aerospace vehicles. 1 cr.

671. AIR FORCE MANAGEMENT AND LEADERSHIP I
An integrated management course emphasizing the individual as a manager in the Air Force. Motivation and behavior, leadership, communication, group dynamics and decision making in a changing environment. Air Force cases studied. 4 cr.

672. AIR FORCE MANAGEMENT AND LEADERSHIP II
Organizational and personal values; management of forces in change; organizational power, politics, managerial strategy and tactics; Air Force cases studied. 4 cr.

681-682. NATIONAL SECURITY FORCES IN CONTEMPORARY AMERICAN SOCIETY I AND II
A full-year course focused on the armed forces as part of American society, emphasizing civil-military relations in context of U.S. policy formulation and implementation. Attitudes toward the military; socialization processes; role of the professional military leader-manager; requirements for adequate national security forces; political, economic, and social constraints on the national defense structure; impact of technological and international developments on strategic preparedness; the variables involved in the formulation and implementation of national security policy; military justice and administrative law. 4 cr each.

Ancient and Modern Languages and Literatures

CHAIRPERSON: F. William Forbes
PROFESSORS: Richard J. Callan, R. Alberto Casás, Warren H. Held, Jr., Charles H. Leighton, Helmut F. Pfanner
ASSOCIATE PROFESSORS: Rose T. Antosiewicz, Roger S. Brown, F. William Forbes, Marron C. Fort, Bernadette Komonchak, John C. Rouman
ASSISTANT PROFESSORS: Richard V. Desrosiers, Linda D. East, Philip D. Rasico, James L. Sherman, Denis M. Sweet, Barbara H. Wing
FACULTY IN RESIDENCE: Gregory W. Allar, Arna Bronstein, Jaime H. DaSilva, Jackie L. Jarest, Wallace P. Sillanpoa, Peter G. Steese
INSTRUCTOR: Aleksandra Mayewski
LECTURERS: Roberta N. Lucas, Marsha B. Robinson, Maria A. Russell
VISITING PROFESSOR: Haruhide P. Mori

Ancient and Modern Languages and Literatures (AMLL)

502. MAJOR TOPICS AND FIGURES

525. STUDIES IN FOREIGN CULTURE AND FILM
Viewing and critical analysis of major foreign films; discussion and concurrent readings in English with emphasis on cultural and literary aspects. Topics will vary; may be repeated for credit. 4 cr.

610. WOMEN IN MODERN LITERATURE

621. COMPARATIVE LITERATURE

791. METHODS OF FOREIGN LANGUAGE TEACHING
Interdepartmental course. Objectives, methods, and techniques in teaching foreign languages from elementary grades through college. Discussion, demonstration, preparation of instructional materials, microteaching of the language skills. A) German; B) Latin; C) Russian; D) Spanish; E) Greek. Prereq: permission. (Also offered as Fren 791.) 4 cr.

Classics (Clas)

(For program description, see page 26)

501. CLASSICAL MYTHOLOGY
Survey of the myths and sagas of ancient Greece and Rome. No classical preparation necessary. Background course for majors in English, the arts, music, history, classics, etc. One session weekly devoted to related art and music. 4 cr.

506. INTRODUCTION TO COMPARATIVE AND HISTORICAL LINGUISTICS
Major language families (primarily Indo-European) and the relationships among languages within a family. Diachronic studies; methods of writing; linguistic change; glottochronology; etymological studies. Some language training and Ling 505 desirable. (Also offered as Ling 506.) 4 cr.

511. MAJOR GREEK AUTHORS IN ENGLISH
Major classical authors such as Homer, the Tragedians of Athens, Herodotus, Thucydides, and Plato in the context of their civilization, from which so much of our contemporary culture derives. For students unprepared to read Greek. Background for majors in English, history, Latin, Greek, the arts, music, philosophy, modern languages, etc. Open to all students. 4 cr.

512. MAJOR LATIN AUTHORS IN ENGLISH
Major classical authors such as Plautus, Terence, Cicero, Catullus, Vergil, Ovid, Seneca, Juvenal, and Tacitus in the context of their civilization, from which so much of our contemporary culture derives. For students unprepared to read Latin. Background for majors in English, philosophy, history, Latin, Greek, the arts, music, modern languages, etc. Open to all students. 4 cr.

521, 522. MASTERPIECES OF GRECO-ROMAN CULTURE IN ENGLISH
More advanced study of the writings of classical civilization centered on a single theme and taught in the Socratic method. For students with some classical preparation, although no knowledge of the Greek and Latin languages is required. Background for prelaw students as well as majors in English, history, Latin, Greek, modern languages, and political science. 4 cr.

525, 526. GREEK AND LATIN ORIGINS OF MEDICAL TERMS
A study of medical terminology. Exercises in etymology and the development of vocabulary in a context at once scientific, historical, and cultural. No knowledge of Greek or Latin is required. Useful to premedical, predental, preveterinary, nursing, medical technology, and other students in the biological and physical sciences. Open to all students. 2 or 4 cr.

595, 596. TOPICS IN CLASSICS
Introduction and elementary study related to linguistic study of Latin and Greek or relevant to Greco-Roman culture and history. Primarily for students unprepared to read Latin and Greek. Topics: A) Byzantine Heritage; B) Grammar: Comparative Study of English and the Classical Languages; C) Greek and Latin Origins of Legal Terms; D) Greek and Latin Origins within the English Language; E) Hellenic Institutions; F) Roman Institutions; G) Classical Backgrounds of Modern Literature; H) Sanskrit; I) Hittite; J) Classical Archaeology. 2 or 4 cr.

695,696. SPECIAL STUDIES IN CLASSICS
Advanced work in classics. Research paper. Not open to freshmen and sophomores. 2 or 4 cr.

German (Germ)

(For program description, see page 29)

New students will be assigned to the proper course on the basis of their scores on the College Board Achievement Test. Transfer credit will not be given for elementary-level college courses in foreign languages if a student has had two or more years of the foreign language in secondary school.

401-402. ELEMENTARY GERMAN
For students without previous training in German. Aural comprehension, speaking, writing, reading. Labs. (No credit for students who have had two or more years of German in secondary school; however, any such students whose studies of German have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 4 cr.

403-404. GERMAN FOR READING KNOWLEDGE
Reading in the natural, physical, and social sciences and the humanities. Previous knowledge of German not required. (No credit for students who have had two or more years of German in secondary school; however, any such students whose studies of German have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 4 cr.

407. ACCELERATED GERMAN
401-402 in one semester. Active use of the German language. Labs. Previous knowledge of German not required. (No credit for students who have had two or more years of German in secondary school; however, any such students whose studies of German have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 8 cr.

501. REVIEW OF GERMAN
Emphasis upon aural-oral practice; review of basic structures; reading and writing to develop active command of the language. Labs. Designed primarily for those whose study of German has been interrupted and for those who have had only two years of high school German. 4 cr.

503-504. INTERMEDIATE GERMAN
A continuation of Germ 401-402. Instruction in German. Labs. 4 cr.

525. INTRODUCTION TO GERMAN CULTURE AND CIVILIZATION
Aspects of the political, social, and cultural life of West Germany, East Germany, Austria, and Switzerland. Conducted in English. This course or its equivalent required of all German majors and strongly recommended for students planning to study abroad. 4 cr.

601. GERMAN CONVERSATION AND PHONETICS
Intensive oral practice with emphasis on pronunciation and vocabulary building. Discussions and short reports on topics of current interest. Required of all German majors and strongly recommended for students planning to study abroad. Prereq: German 504 or equivalent. 4 cr.

631-632. ADVANCED LANGUAGE AND STYLE
Essential for all students intending to engage in study or research in a German-speaking country. Essays and oral reports. Required of all German majors; not open to students who will have taken the equivalent courses abroad. 4 cr.

656. INTRODUCTION TO GERMAN LITERATURE
Reading and analysis of poems, dramas, and short prose; introduction to theory of literary forms. Conducted in German. This course or its equivalent required of all German majors going on the Salzburg program; prerequisite to upper-level literature courses. 4 cr.

685, 686. STUDY ABROAD
Studies at a German-speaking university such as the University of Salzburg (Austria). Students are expected to attend a four-week, noncredit orientation seminar in Salzburg before the beginning of the fall semester. Open to all students regardless of major. Interested students should consult German adviser or the Salzburg representative. Prereq: completion of sophomore year; 4 full courses in Germ with B (3.00) average; overall grade-point average of C+ (2.33); Germ 656 for Germ majors; Germ 601 recommended. Variable to 16 cr.

693, 694. MAJOR GERMAN AUTHORS IN ENGLISH
Critical reading of major works of one of the following authors. Conducted in English. (German majors read all works in original.) A) Brecht; B) Frisch and Dürrenmatt; C) Other. Barring duplication of material, course may be repeated for credit. 4 cr.

723. SURVEY OF PRECLASSICAL GERMAN LITERATURE
German literature from its beginning until the late 18th century. Prereq: Germ 656. 4 cr.

724. THE AGE OF GOETHE
Major literary movements between 1770 and 1832. Reading and analysis of selected works. Prereq: Germ 656. 4 cr.

726. GERMAN CULTURE AND CIVILIZATION
Historical, social, artistic, and folkloristic developments in German-speaking countries from the beginning to the present. Prereq: Germ 525 or permission. 4 cr.

727. GERMAN LITERATURE OF THE 19th CENTURY
Major literary movements from Goethe's death to the unification of Germany by Bismarck (1832-1872). Reading and analysis of selected works. Prereq: Germ 656. 4 cr.

728. MODERN GERMAN LITERATURE
Major literary movements from 1872 to the present. Reading and analysis of selected works. Prereq: Germ 656. 4 cr.

733. HISTORY AND DEVELOPMENT OF THE GERMAN LANGUAGE
The changes in sounds, structure, and vocabulary from the earliest record to the present. 4 cr.

795, 796. SPECIAL STUDIES IN GERMAN LANGUAGE AND LITERATURE
A) Cultural Comparison of the U.S. and Germany; B) North Germany: Land and People; C) Masterworks of German Cinema; D) German and Austrian Exile Literature 1933-1945; E) German for Graduate Students; F) Berlin and the Berliners. Barring duplication of subject, may be repeated for credit. 2 or 4 cr.

Greek (Grek)

(For program description, see page 29)

New students will be assigned to the proper course on the basis of their scores on the College Board Achievement Test. Transfer credit will not be given for elementary-level college courses in foreign languages if a student has had two or more years of the foreign language in secondary school.

401-402. ELEMENTARY GREEK
Grammar, simple composition, and translation. (No credit for students who have had two or more years of Greek in secondary school; however, any such students whose studies of Greek have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 4 cr.

403-404. ELEMENTARY MODERN GREEK
Aural-oral practice and the study of fundamental speech patterns, reading, and writing to achieve a firm basis for an active command of the language. Lab. 4 cr.

503-504. INTERMEDIATE GREEK
Readings from Xenophon, Plato, Herodotus, Euripides, and the New Testament. Prereq: Grek 402. 4 cr.

631-632. GREEK PROSE COMPOSITION
Review of Attic Greek grammar; study of Greek prose style; English to Greek translation. Prereq: permission. 4 cr.

751, 752. HOMER AND THE ARCHAIC PERIOD
Readings from the *Iliad,* the *Odyssey,* the Homeric hymns, Hesiod, Pindar, and the lyric poets. Prereq: permission. 4 cr.

753, 754. ADVANCED STUDIES IN ATHENIAN LITERATURE
A) Aeschylus; B) Sophocles; C) Euripides; D) Aristophanes; E) Herodotus; F) Thucydides; G) Xenophon; H) Plato; I) Aristotle; J) Lysias; K) Demosthenes; L) Isocrates. Major Attic authors from the Battle of Marathon to the death of Alexander the Great. Prereq: permission. 4 cr.

795, 796. SPECIAL STUDIES IN GREEK
A) Pre-Socratic Philosophers; B) Hellenistic Greek Authors; C) Menander; D) Callimachus; E) Apollonius of Rhodes; F) Theocritus; G) Polybius; H) Greek Authors of the Roman Empire; I) Plutarch; J) Septuagint; K) New Testament; L) Greek Church Fathers; M) Byzantine Authors; N) Spoken Greek; O) Advanced Greek Composition; P) Introduction to Classical Scholarship; Q) Greek Epigraphy; R) Greek Dialects; S) Comparative Grammar of Greek and Latin; T) Homer: A Linguistic Analysis; U) Greek Institutions; V) Palaeography and Textual Criticism. Topics selected by instructor and student in conference. Prereq: permission. 2 or 4 cr.

Italian (Ital)

New students will be assigned to the proper course upon consultation with the section coordinator. Students educated in Italian-speaking countries may not register for courses below the 700 level. Transfer credit will not be given for elementary-level college courses in foreign languages if students have had two or more years of the foreign language in secondary school.

401-402. ELEMENTARY ITALIAN
For students without previous training in Italian. Aural comprehension, speaking, writing, reading. Labs. No credit for Ital 401 without Ital 402. (No credit for students who have had two or more years of Italian in secondary school; however, any such students whose studies of Italian have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 4 cr.

407. ACCELERATED ITALIAN
Ital 401-402 in one semester. Aural comprehension, speaking, writing, reading. Labs. (No credit for students who have had two or more years of Italian in secondary school; however, any such students whose studies of Italian have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 8 cr.

503-504. INTERMEDIATE ITALIAN
A complete review of the fundamentals of grammar and syntax. Selected readings as a general introduction to Italian civilization and culture. Labs. 4 cr.

605. INTRODUCTION TO ITALIAN CULTURE AND CIVILIZATION I: MIDDLE AGES, RENAISSANCE, BAROQUE
Survey of major representative writers and artists, studied against the backdrop of social and cultural history. Prereq: grade of C (2.00) or better in Ital 504 or permission. 4 cr.

606. INTRODUCTION TO ITALIAN CULTURE AND CIVILIZATION II: AGE OF ENLIGHTENMENT, ROMANTICISM, MODERNISM
Survey of major representative writers and artists, studied against the backdrop of social and cultural history. Prereq: grade of C (2.00) or better in Ital 504 or permission. 4 cr.

795, 796. INDEPENDENT STUDY IN ITALIAN LANGUAGE AND LITERATURE
Individual guided study. Prereq: permission. 1-4 cr.

Japanese (Russ)

415-416. ELEMENTARY JAPANESE
Elements of Japanese grammar. Oral practice and written drills designed to achieve a mastery of basic grammatical patterns. Reading of graded exercises introducing the student to written Japanese (Hiragana and Katakana) and Chinese characters used in contemporary Japan. Labs. (No credit for students who have had two or more years of Japanese in secondary school; however, any such students whose studies of Japanese have been interrupted for a significant period of time should consult the department chairperson about possibly receiving credit.) 4 cr.

515-516. INTERMEDIATE JAPANESE
Review of Japanese grammar. Reading of prose and practice in oral and written expression. Emphasis upon contemporary Japanese. Labs. Prereq: permission; /or Russ 416 with a grade of C (2.00) or better. 4 cr.

517-518. TOPICS IN JAPANESE LANGUAGE
Further work in Japanese for those who have completed Russ 516. Prereq: permission. 2 cr.

Latin (Latn)

(For program description, see page 30)

New students will be assigned to the proper course on the basis of their scores on the College Board Achievement Test. Transfer credit will not be given for elementary-level courses in foreign languages if a student has had two or more years of the foreign language in secondary school.

401-402. ELEMENTARY LATIN
Elements of grammar, reading of simple prose. Course cannot be counted for major credits. (No credit for students who have had two or more years of Latin in secondary school; however, any such students whose studies of Latin have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 4 cr.

501. REVIEW OF LATIN
Intensive review of Latin grammar and vocabulary. Designed primarily for those whose study of Latin

has been interrupted for a year or more and for those who have had only two years of high school Latin. 4 cr.

503-504. INTERMEDIATE LATIN
Review. Readings from Cicero, Caesar, Sallust, Livy, Catullus, Horace, Ovid, Plautus, Terence, and Seneca. Prereq: Latn 402 or equivalent. 4 cr.

631-632. LATIN PROSE COMPOSITION
Grammar review; study of Latin prose style; English to Latin translation. Prereq: permission. 4 cr.

751, 752. CICERO AND THE ROMAN REPUBLIC
Prereq: permission. 4 cr.

753, 754. ADVANCED STUDIES IN THE LITERATURE OF THE GOLDEN AGE
A) Lucretius; B) Catullus; C) Caesar; D) Sallust; E) Vergil; F) Horace; G) Tibullus; H) Propertius; I) Ovid; J) Livy. Major Roman authors from the dictatorship of Sulla to the death of Augustus. Prereq: permission. 4 cr.

755, 756. ADVANCED STUDIES IN THE LITERATURE OF THE SILVER AGE
A) Seneca the Younger; B) Persius; C) Petronius; D) Lucan; E) Statius; F) Quintilian; G) Martial; H) Juvenal; I) Tacitus; J) Pliny the Younger. Major Roman authors from the reign of Nero to the death of Trajan. Prereq: permission. 4 cr.

795, 796. SPECIAL STUDIES IN LATIN
A) Minor Authors of the Republic; B) Plautus; C) Terence; D) Minor Authors of the Empire; E) Suetonius; F) Latin Church Fathers; G) Medieval Latin; H) Advanced Latin Composition; I) Introduction to Classical Scholarship; J) Latin Epigraphy; K) Italic Dialects; L) Comparative Grammar of Greek and Latin; M) Roman Law. Topics selected by instructor and student in conference. Prereq: permission. 2 or 4 cr.

Russian (Russ)

(For program description, see page 33)

New students will be assigned to the proper course on the basis of their scores on the College Board Achievement Test. Transfer credit will not be given for elementary-level college courses in foreign languages if a student has had two or more years of the foreign language in secondary school.

401-402. ELEMENTARY RUSSIAN
Oral-aural practice and written drills designed to achieve a mastery of basic grammatical patterns. Language Laboratory work required. Previous knowledge of Russian not required. (No credit for students who have had two or more years of Russian in secondary school; however, any such students whose studies of Russian have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 4 cr.

503-504. INTERMEDIATE RUSSIAN
Continuation of Russ 401-402. Review of Russian grammar, reading of prose, and practice in oral and written expression. Labs. Prereq: Russ 402 or equivalent high school or college course with a grade of C or better. 4 cr.

505, 506. RUSSIAN FOR CONVERSATION
Designed to increase fluency in Russian conversation and improve phonetic articulation. Students are advised to take this as a sequence along with Russ 503-504. Prereq: Russ 401-402; /or permission. 2 cr.

521. SURVEY OF RUSSIAN LITERATURE IN ENGLISH
Selected masterpieces of 19th- and 20th-century Russian literature. Pushkin, Gogol, Tolstoy, Dostoevsky, Chekhov, Pasternak, Solzhenitsyn, and others. Lectures and readings in English. Open to all students, including freshmen. Majors are required to take Russ 691 concurrently. 4 cr. (Fall semester only.)

525. INTRODUCTION TO RUSSIAN CULTURE AND CIVILIZATION
A survey course, thematically organized, drawing upon Russian and Soviet literature, history, politics, art, and ideological currents to create a composite portrait of the evolution of Russian and Soviet culture. (Also offered as Hist 563.) 4 cr.

585. RUSSIAN LANGUAGE SEMINAR IN THE SOVIET UNION
Five weeks of Russian language classes on all levels conducted in Leningrad, 4 hours per day, 6 days per week. No prerequisites. 4 cr. (Summers only.)

586. RUSSIAN LANGUAGE SEMINAR, CIVILIZATION, AND CULTURE IN THE SOVIET UNION
Five weeks of culture and civilization classes and field trips to museums, art galleries, schools, factories, etc. Classes and excursions average 3 hours per day, 6 or sometimes 7 days per week. No prerequisites. 1-4 cr. (Summers only.)

593. MAJOR RUSSIAN AUTHORS IN ENGLISH
In-depth discussion and analysis of major Russian authors or literary periods. A different author or period offered each semester. Lectures and readings in English. Not for major credit; majors must register for Russian 693. 4 cr. (Spring semester only.)

631-632. ADVANCED RUSSIAN CONVERSATION AND COMPOSITION
Advanced spoken and written Russian to maintain aural-oral fluency; advanced grammar. Individual conferences. Prereq: Russ 503-504 or equivalent. 4 cr.

691. READINGS IN RUSSIAN LITERATURE
Taken concurrently with Russ 521 but may be taken separately with permission of instructor. Linguistic and stylistic characteristics of the works covered in Russ 521. Readings and lectures entirely in Russian. 2 cr. (Fall semester only.)

692. DRAMA
Taught in Russian, as a complement to Russ 693. Plays chosen to parallel the authors covered in Russ 521 or 693. Final project is a play production. 2 cr. (Spring semester only.)

693. MAJOR RUSSIAN AUTHORS
Same as Russ 593, except that majors do selected readings in Russian and meet with instructor one extra hour each week. Extra hour is taught entirely in Russian. 4 cr. (Spring semester only.)

694. SELECTED READINGS IN RUSSIAN CULTURE AND CIVILIZATION
The major historical and cultural events since the beginning of the Russian state. Lectures and readings in Russian. Prereq: Russ 504. 2 cr.

733. ADVANCED LANGUAGE AND STYLE
For students who have a strong, active control of grammar. The most difficult problems of Russian grammar and syntax; poetry and prose. Develops confidence in expression both in everyday situations and in abstract concepts (emphasis on the latter). 4 cr.

734. HISTORY AND DEVELOPMENT OF THE RUSSIAN LANGUAGE
Overview of the changes in sounds, structure, and vocabulary from Proto-Indoeuropean through Old Church Slavonic, Old Russian, to Contemporary Russian. Emphasis on changes in the literary language from the end of the 18th century to the present. Readings in Old Church Slavonic, Old Russian, and 19th- and 20th-century authors. 4 cr.

795, 796. SPECIAL STUDIES IN RUSSIAN LANGUAGE AND LITERATURE
Selected topics in language, culture, and literature. 1-4 cr.

Spanish (Span)

(For program description, see page 34)

New students will be assigned to the proper course on the basis of their scores on the College Board Achievement Test. Transfer credit will not be given for elementary-level college courses in foreign languages if a student has had two or more years of the foreign language in secondary school. No student educated in a foreign country or for whom Spanish is the native tongue will be permitted to register for any Spanish course numbered 650 or below. All courses conducted in Spanish (or Portuguese) except where noted.

401-402. ELEMENTARY SPANISH
For students without previous knowledge of Spanish. Aural-oral practice; fundamental speech patterns; reading and writing to achieve a firm basis for an active command of Spanish. Labs. No credit toward a major. (No credit for students who have had two or more years of Spanish in secondary school; however, any such students whose studies of Spanish have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) A) Human Services. 4 cr.

403-404. ELEMENTARY PORTUGUESE
For students without previous knowledge of Portuguese. Aural-oral practice; fundamental speech patterns; reading and writing to achieve a firm basis for an active command of the language. Labs. No credit toward a major. (No credit for students who have had two or more years of Portuguese in secondary school; however, any such students whose studies of Portuguese have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 4 cr.

407. ACCELERATED SPANISH
Span 401-402 in one semester. Study of fundamental speech patterns, reading and writing to achieve a firm basis for active command of Spanish. Labs. Previous knowledge of Spanish is not required. (No credit for students who have had two or more years of Spanish in secondary school; however, any such students whose studies of Spanish have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 8 cr.

501. REVIEW OF SPANISH
Emphasis on aural-oral practice; review of basic structure; reading and writing to develop active command of the language. Labs. Designed primarily for those whose study of Spanish has been interrupted and for those who have had only two years of high school Spanish. 4 cr.

503-504. INTERMEDIATE SPANISH
Complete literary texts of intellectual worth; review of language structure; oral and written expression of ideas. Discussion and papers in Spanish. Labs. Open to students who have passed Span 402 with a C (2.00). No credit toward the major for 503. 4 cr.

507-508. INTERMEDIATE PORTUGUESE
Conversation and composition based on readings in contemporary Portuguese and Brazilian literature, especially theater, which is closest to conventional language. A traditional grammar text supplements reading. Labs. 4 cr.

525. SPANISH CIVILIZATION AND CULTURE
Historical, geographical, and artistic expressions of Spanish civilization which have formed the character of contemporary Spanish culture. Readings, slides, films, tapes, and records. Conducted in English. Majors must take either 525 or 526, but both may not be counted for major credit. 4 cr.

526. LATIN AMERICAN CIVILIZATION AND CULTURE
Significant historical, geographical, and artistic expressions of pre-Colombian and Latin American civilization. Readings, slides, films, tapes, records. Conducted in English. Majors must take either 525 or 526, but both may not be counted for major credit. 4 cr.

601. SPANISH PHONETICS
Practical application of fundamental phonetic theory to spoken Spanish. Required of Spanish majors. 4 cr.

621. SPANISH AND PORTUGUESE LITERATURE IN TRANSLATION
Major works by principal authors, such as: Camões, Cervantes, Lope de Vega, Calderón, Eça de Queiroz, Unamuno, Ortega y Gasset, García Lorca, Casona, etc. Readings, discussions, papers in English. Does not count for Spanish major. 4 cr.

622. LATIN AMERICAN AND BRAZILIAN LITERATURE IN TRANSLATION
Major works by principal authors, such as: Inca Garcilaso, Díaz del Castillo, Machado de Assís, Borges, Asturias, Neruda, E. Veríssimo, Fuentes, Leñero, Guimarães Rosa, and Jorge Amado. Readings, discussion, papers in English. Does not count toward Spanish major. 4 cr.

631, 632. ADVANCED SPANISH CONVERSATION AND COMPOSITION
To maintain and perfect written and spoken Spanish through intensive classroom work, individual conferences, and laboratory sessions. Prereq: Span 504 or equivalent. 4 cr.

One course from Span 650, 651, 652, 653, 654 (or an equivalent course) is prerequisite to all higher literature courses in Spanish.

650. INTRODUCTION TO CRITICAL ANALYSIS
Methods and practice of literary criticism. Critical analysis of representative essays, fiction, poetry, and drama from Spain and Latin America. Frequent short papers. Required of Spanish majors; should be taken concurrently with or immediately following Spanish 632. 4 cr.

651, 652. INTRODUCTION TO SPANISH LITERATURE AND THOUGHT
Reading and analysis of major works within the historical, cultural, and social background of the Iberian peninsula. Papers, discussion, and examinations in Spanish. Prereq: Span 631, 632. May be taken concurrently with Span 632 with permission of adviser. 4 cr.

653, 654. INTRODUCTION TO LATIN AMERICAN LITERATURE AND THOUGHT
Reading and analysis of major works within the historical, cultural, and social background of the New World. Papers, discussion, and examinations in Spanish. Prereq: Span 631, 632. May be taken concurrently with Span 632 with permission of adviser. 4 cr.

685, 686. STUDY ABROAD
Studies at a Spanish or Latin American university. Prereq: primarily for juniors and seniors who have passed Span 503-504 or equivalent with grade of B (3.00) or better. Noncredit orientation meetings required during semester prior to departure. Interested students should consult with the program directors. Variable to 16 cr.

691, 692. READINGS IN CURRENT PERIODICALS
Advanced practice in reading, speaking, and writing, based on current events in contemporary periodicals of the Spanish-speaking world. Co- or prereq: Span 632 or equivalent. May be repeated. 2 cr.

752. DRAMA AND POETRY OF THE SIGLO DE ORO
Social and historical background of the baroque period. Representative plays of Lope de Vega, Tirso de Molina, Calderón; lyric poetry of Lope, Góngora, and Quevedo; prose developments. Prereq: Span 652 or 654 or equivalent. 4 cr. (Not offered every year.)

754. CERVANTES
Cervantes' literary art. Selections from the major works. The Quijote, its originality and significance; its antecedents; its religious, philosophical, and sociological aspects; and its artistic structure. Prereq: Span 652 or 654 or equivalent. 4 cr. (Not offered every year.)

755. LITERATURE OF THE 19th CENTURY
Larra, Espronceda, Bécquer, Pérez Galdós, and Blasco Ibáñez. Romanticism, realism, and naturalism. Prereq: Span 652 or 654 or equivalent. 4 cr. (Not offered every year.)

757. THEATER AND POETRY OF THE 20th CENTURY
The Generation of 1898 and Modernismo: Lorca, Casona, Buero Vallejo, Sastre, Salinas, Guillén, and Miguel Hernández. Prereq: Span 652, 654, or equivalent. 4 cr. (Not offered every year.)

758. SPANISH PROSE OF THE 20th CENTURY
Novels, short stories, and essays. Unamuno, Baroja, Menéndez Pidal, Ortega y Gasset, Julián Marías, Aranguren, Pérez de Ayala, Gironella, and Cela; survey of contemporary prose. Prereq: Span 652, 654, or equivalent. 4 cr. (Not offered every year.)

760. UNAMUNO AND ORTEGA Y GASSET
Philosophical ideology and literary content of major contributions of Miguel de Unamuno and José Ortega y Gasset. Prereq: Span 652, 654, or equivalent; /or permission. 4 cr. (Not offered every year.)

771. LATIN AMERICAN DRAMA
From pre-Hispanic origins to the present, modern playwrights of Mexico and Puerto Rico. Prereq: Span 652, 654, or equivalent. 4 cr. (Not offered every year.)

772. LATIN AMERICAN NOVEL
Development from romanticism to the present; contemporary trends and techniques. Prereq: Span 652, 654, or equivalent. 4 cr. (Not offered every year.)

773. LATIN AMERICAN SHORT STORY
Representative authors; stress on 20th century. Principles of interpretation. Prereq: Span 652, 654, or equivalent. 4 cr. (Not offered every year.)

774. MAJOR LATIN AMERICAN AUTHORS
Works and lives of selected writers; pertinent historical circumstances. Prereq: Span 652, 654, or equivalent. 4 cr. (Not offered every year.)

790. ADVANCED SPANISH GRAMMAR
Review of Spanish grammar and syntax. Prereq: Span 632. 4 cr.

795. SPECIAL STUDIES IN SPANISH LANGUAGE AND LITERATURE
A) The History of the Spanish Language; B) Medieval Spanish Literature; C) Spanish Literature of the Renaissance; D) Spanish Literature of the Golden Age; E) Spanish Literature of the 18th and 19th Centuries; F) Spanish Literature of the 20th Century (1898-1936); G) Contemporary Spanish Literature; H) Latin American Literature of the 16th and 17th Centuries; I) Latin American Literature of the 18th and 19th Centuries; J) Latin American Literature of the 20th Century; K) Contemporary Latin American Literature; L) Structural and Applied Linguistics; M) Spanish Literary Criticism; N) Latin American Essay; O) Latin America; P) Catalan; Q) Spanish Poetry; R) Latin American Poetry; S) Galdós; T) Archetype Latin American Literature; U) Special Teaching Problems; V) Spanish Civilization and Culture;

W) Latin American Civilization and Culture; X) Borges; Y) Spanish Theater; Z) Spanish for Graduates. Guided study with training in bibliography and organization of material. Topics selected by instructor and student in conference. Prereq: permission of the major supervisor. 2 or 4 cr.

796. SPECIAL STUDIES IN SPANISH LANGUAGE AND LITERATURE
A) Hispanic Minorities of the United States; B) Hispanic Film; C) Introduction to Hispanic Linguistics; D) Hispanic Dialectology. Guided study with training in bibliography and organization of material. Topics selected by instructor and student in conference. Prereq: permission of the major supervisor. 2 or 4 cr.

Animal Sciences (AnSc)

(For program description, see page 40)

CHAIRPERSON: Thomas P. Fairchild
PROFESSORS: Walter M. Collins, Thomas P. Fairchild, James B. Holter, Samuel C. Smith, Richard G. Strout
ASSOCIATE PROFESSORS: William C. Condon, Walter E. Hylton, Charles Schwab, Henry J. Thompson, Willard E. Urban
ASSISTANT PROFESSORS: William E. Berndtson, Janet C. Briggs, Roger A. Cady, Ginny W. Darr, Richard W. Fite, Colette H. Janson, Alan H. Parsons, Anthony R. Tagliaferro, Roger E. Wells
LECTURERS: Joseph J. Moore, Elizabeth C. Smith

400. ANIMALS, FOOD, AND MAN
Nutrition and food science; biological, social, political, economic, and historical significance of food. Animal food products. (Also offered as Nutr 400.) 4 cr.

401. INTRODUCTION TO THE ANIMAL SCIENCES
Development, economic importance, and problems of the livestock industry; commercially important classes of farm animals; and the place of the biological sciences in animal agriculture. Lab. 4 cr.

402. HORSEMANSHIP
For beginning, intermediate, and advanced riders. Basics of balance seat, specializing in basic dressage and combined training. Limited number of students may stable their horses at the University. A fee is charged. May be repeated for a maximum of 12 credits. 2 cr.

404. INTRODUCTION TO LIGHT HORSE SCIENCE
Conformation, breeds, feeding, breeding, genetics, stable management, diseases, and other aspects of the light horse science field. Lab. 4 cr.

406. CAREERS IN ANIMAL SCIENCE
A survey of various areas of animal and veterinary science and opportunities available. Required of all AnSc and pre-vet freshmen; open to others by permission. 1 cr. Cr/F.

501. ANIMAL ANATOMY AND PHYSIOLOGY
General anatomy and physiology of domestic animals and birds. 4 cr.

502. FUNDAMENTALS OF ANIMAL HEALTH
Principles of disease mechanisms: causes, body reactions, and immunology. Prerequisite for other AnSc disease courses. 2 cr.

503. ABATTOIR MANAGEMENT
Licensing requirements, sanitation, inspection facilities, and use of the slaughterhouse; field trips. Prereq: permission. Lab. 2 cr.

504. MEAT AND ITS PRODUCTS
Slaughtering, cutting, and identification of beef, lamb, pork, and poultry; field trips. Lab. 4 cr.

507. THE SCIENTIFIC APPROACH TO EQUINE DISCIPLINE
Physiological development, control, and education; bitting, longeing, driving and equine gymnastics. Prereq: AnSc 402; permission. Lab. 2 cr.

508. ANIMAL MANAGEMENT CLINIC
Instruction in field situations for AnSc and pre-vet majors; experience in animal management techniques and procedures. 508A, Livestock; 508B, Dairy. Prereq: permission. Same section may not be repeated for credit. 2 cr. Cr/F.

601-602. ANIMAL SELECTION
Principles of selection based on production performance, pedigree, and type evaluation. 601-1. Livestock; 602-2. Dairy; 602-3. Light Horses. Prereq: permission. Same section may not be repeated. Lab. 2 cr.

603. APPLIED ANIMAL NUTRITION
Application of scientific principles of nutrition to feed formulation and feeding systems for poultry and livestock. Lab. 4 cr.

605. PRINCIPLES OF NUTRITION
Principles underlying nutrition of humans and animals; digestion, absorption, intermediate metabolism, and excretion of nutrients; function of nutrients in maintenance, growth, and production; metabolic disorders resulting from inappropriate intake of nutrients, and diseases. Prereq: 1 year of chemistry; 1 semester of physiology. (Also offered as Nutr 605.) Lab. 4 cr.

606. EQUINE DISEASES AND PARASITES
Common veterinary problems of horses, including infectious diseases, colic, parasites, and lameness. Prereq: AnSc 502 or equivalent. 2 cr.

607. SMALL ANIMAL DISEASES
Common diseases in companion animals; emphasis on canine and feline medicine. Prereq: AnSc 502. 2 cr.

609. LIVESTOCK DISEASES
Common veterinary problems of dairy and beef cattle, sheep, goats, and swine. Prereq: AnSc 502 or equivalent. 2 cr.

614. DISEASES AND PARASITES OF WILDLIFE
An ecological approach to some of the more common diseases and parasites of fishes, birds, game, and fur-bearing mammals. Influence of environment and management practices on the incidence and severity of diseases; relationship of wildlife diseases to human health. Prereq: permission. 3 cr.

616. WILDLIFE DISEASE LABORATORY
Demonstrates necropsy techniques and examination of wildlife specimens for common parasitic and other diseases. Restricted to wildlife management majors only. Prereq: AnSc 614, or may be taken concurrently. 1 cr. Cr/F.

617. LIVESTOCK DISEASE CLINIC
Disease principles applied to clinical cases in the University herds and flocks; practical treatments and methods. Should be taken concurrently with AnSc 609. Prereq: AnSc 502 and permission. 2 cr.

618. EQUINE DISEASE CLINIC
Disease principles applied to clinical cases in the University herd. Should be taken concurrently with AnSc 606. Prereq: AnSc 502 and permission. 2 cr.

651-652. MANAGEMENT OF DOMESTIC ANIMALS
Economic and management factors of the production of various economic species. Students may select any or all of the following specialized areas: 651-1. Light Horse; 651-2. Dairy; 652-3. Livestock; 652-4. Poultry. Prereq: permission. Lab. 4 cr. (Some sections offered on alternate year basis.)

653-654. PRINCIPLES OF TEACHING EQUITATION
Teaching techniques and procedures, with emphasis on dressage; opportunity to teach riding theory and techniques to other students under supervision of instructor. Teaching certificate awarded to students successfully completing course. Prereq: AnSc 402, 507, and 651-1; permission. A fee is charged. Lab. A year-long course; 4 cr. each semester, 8 cr. total, an "IA" grade (continuous course) given at the end of first semester. Withdrawal from course results in loss of credit.

697. ANIMAL SCIENCE SEMINAR
Survey: recent literature and research. 2 cr.

701. PHYSIOLOGY OF REPRODUCTION
Comparative aspects of embryology, anatomy, endocrinology, and physiology of reproduction. Lab. 4 cr.

702. EXPERIMENTAL ENDOCRINOLOGY OF REPRODUCTION
Discussions of current research literature plus application of laboratory techniques to the study of hormone relationships in the reproductive system. Prereq: AnSc 701 and permission. Lab. 4 cr.

704. PRINCIPLES OF PATHOBIOLOGY
Principles of disease processes; reactivity of the diseased cell, tissue, and organ. Prereq: AnSc 501, 502, and a 600-level disease course; /or permission. 3 cr.

709. BIOCHEMISTRY OF NUTRITION
Intermediary metabolism of nutrients and energy; metabolism transport mechanisms; biological oxidations; interrelationships of carbohydrate, fat, and protein metabolism; obesity; control of hunger and appetite. Prereq: college course in biochemistry. Lab. (Also offered as Nutr 709.) 4 cr.

710. ANIMAL NUTRITION
Feeding and related management of farm animals with special emphasis on dairy cattle; nutrients and their use, digestive anatomy and physiology, energy systems, forage systems and quality, ration balancing (dairy, beef, sheep, poultry, swine, and equine), and selected metabolic disorders. Prereq: AnSc 605 or permission. (Also offered as Nutr 710.) 5 cr.

711. COMPARATIVE ANIMAL GENETICS
How heredity affects domestic animals, poultry, other mammals, and fish; emphasis on the organism and population. Quantitative inheritance; principles of selection; disease resistance; statistical and experimental techniques. Prereq: 4 cr. of genetics or permission. Lab. 4 cr.

712. ANIMAL BREEDING AND IMPROVEMENT
Principles of selection and breeding systems as they apply to the genetic improvement of dairy cattle, livestock and horses. Prereq: AnSc 711 or permission. Lab. 4 cr. (Not offered every year.)

714. INTRODUCTION TO ELECTRON MICROSCOPY
Principles, theory, and methods used in preparing and examining vertebrate tissues in transmission and scanning electron microscopes. Interpretation of electron micrographs. Prereq: general chemistry; permission. 3 cr.

715. INTRODUCTION TO ELECTRON MICROSCOPY LAB
Application of principles and theories presented in AnSc 714. Fixation embedding ultramicrotomy, critical point drying operation of transmission and scanning electron microscopes and photographic procedures. Coreq: AnSc 714. Permission. 2 cr.

795, 796. INVESTIGATIONS IN DAIRY, LIVESTOCK, POULTRY
Problems in: 1) Genetics; 2) Nutrition; 3) Management; 4) Diseases; 5) Products; 6) Light Horsemanship; 7) Physiology; 8) Cell Biology. Prereq: permission. May be repeated. 1-4 cr.

Anthropology

(See Sociology and Anthropology)

The Arts (Arts)

(For program description, see page 26)

CHAIRPERSON: Winifred C. Shaw
PROFESSORS: Sigmund M. Abeles, John W. Hatch, John L. Laurent, Melvin J. Zabarsky
ASSOCIATE PROFESSORS: David S. Andrew, Arthur E. Balderacchi, Margot Clark, F. Conley Harris, Michael McConnell, Richard D. Merritt, Maryse P. Searls, Winifred C. Shaw, Daniel L. Valenza
ASSISTANT PROFESSORS: Carol Aronson, David R. Smith, Mara R. Witzling
FACULTY IN RESIDENCE: Craig A. Hood, Scott Schnepf
ADJUNCT PROFESSOR: Susan Faxon Olney

Two-Dimensional Courses

All courses elective by permission of the Department of the Arts.

The following courses are sequential drawing experiences, from the basic elements of line, form, space, etc., in various drawing media, concentrat-

ing on still-life and figure, and leading to conceptual exercises with emphasis on the individual's drawing development.

432. DRAWING I
Lab. 4 cr.

532. DRAWING II
Prereq: Arts 432. Lab. 4 cr.

533. DRAWING III
Prereq: Arts 532. Lab. 4 cr.

632. DRAWING IV
Prereq: Arts 533. Lab. 4 cr.

633. DRAWING V
Prereq: Arts 632. Lab. 4 cr.

455. INTRODUCTION TO ARCHITECTURE
Study of architectural graphics, design theories, form determinants, and the architect in society. Course includes case study projects. Lab. 4 cr.

536. INTRODUCTORY PRINTMAKING
Graphic arts in a range of media. Prereq: Arts 532. Lab. 4 cr.

The following courses are sequential painting experiences. Aspects of composition, color, and conceptualization.

546. OIL PAINTING I
Prereq: Arts 432. Lab. 4 cr.

547. OIL PAINTING II
Prereq: Arts 546. Lab. 4 cr.

646. OIL PAINTING III
Prereq: Arts 547. Lab. 4 cr.

647. OIL PAINTING IV
Prereq: Arts 646. Lab. 4 cr.

746. PAINTING V
Prereq: Arts 647. Lab. 4 cr.

747. PAINTING VI
Prereq: Arts 746. Lab. 4 cr.

544. WATER MEDIA I
Transparent and opaque water color. Prereq: Arts 546. Lab. 4 cr.

551. PHOTOGRAPHY I
Theory and practice of black-and-white creative photography. Students should provide their own cameras. Lab. 4 cr.

552. PHOTOGRAPHY II
Theory and practice of creative color photography. Camera and laboratory manipulative methods in black and white and/or color. Students should provide their own cameras. Prereq: Arts 551. Lab. 4 cr.

598. SOPHOMORE SEMINAR
Encourages experimentation by integrating verbal and plastic understandings through readings, discussions, studio work. Field trips. Prereq: 2 art history courses and 2 studio arts courses. 4 cr.

636, 637. PRINTMAKING WORKSHOP
Prereq: Arts 536. Lab. 4 cr.

645. WATER MEDIA II
Continuation of Arts 544; introduction to other water-based media. Prereq: Arts 544 or 547. Lab. 4 cr.

651. PHOTOGRAPHY III
Application of new materials and methods. Students should provide their own cameras. Prereq: Arts 552. Lab. 4 cr.

695. SPECIAL PROBLEMS IN THE VISUAL ARTS
See description under Three-Dimensional Courses.

796. INDEPENDENT STUDY IN THE VISUAL ARTS
A) Photography; B) Sculpture; C) Drawing; D) Painting; E) Graphics; F) Water Media; G) Architectural Design; H) Curatorial Assistant; I) Art History; J) Ceramics; K) Jewelry and Metalsmithing; L) Weaving; M) Wood Design. Open to highly qualified juniors and seniors. Prereq: permission of department chairperson and supervising faculty member or members. May be repeated to a total of 8 cr. 1-8 cr.

798. SEMINAR/SENIOR THESIS
Readings and discussions oriented toward the intellectual premises of art. Culminates in mounting an exhibition of the student's work. Required of all students in the B.F.A. program. Other advanced students may elect with instructor's permission. A year-long course; an "IA" grade (continuous course) will be given at the end of the first semester. Lab. 8 cr.

Three-Dimensional Courses

All courses elective by permission of the Department of the Arts.

The following courses are sequential ceramics experiences. These courses cover all methods of basic construction, decoration, glazing and firing, with particular emphasis on each individual's perceptual development.

501. CERAMICS I
Prereq: Arts 432. Lab. 4 cr.

502. CERAMICS II
Prereq: Arts 501. Lab. 4 cr.

601. CERAMICS III
Prereq: Arts 502. Lab. 4 cr.

701. CLAY AND GLAZE FORMULATION
Prereq: Arts 502; 601. Lab. 4 cr.

The following courses are sequential metalsmithing experiences. Methods and materials of jewelry making and metalsmithing.

513. JEWELRY AND METALSMITHING I
Lab. 4 cr.

514. JEWELRY AND METALSMITHING II
Prereq: Arts 513. Lab. 4 cr.

613. JEWELRY AND METALSMITHING III
Prereq: Arts 514. Lab. 4 cr.

The following courses are sequential weaving experiences using four- to eight-harness looms.

519. WEAVING I
Lab. 4 cr.

520. WEAVING II
Prereq: Arts 519. Lab. 4 cr.

619. WEAVING III
Prereq: Arts 520. Lab. 4 cr.

The following courses are sequential sculpture experiences. Principles, methods, and concepts of sculpture.

567. SCULPTURE I
Prereq: Arts 432. Lab. 4 cr.

568. SCULPTURE II
Prereq: Arts 567. Lab. 4 cr.

667. SCULPTURE III
Prereq: Arts 568. Lab. 4 cr.

668. SCULPTURE IV
Prereq: Arts 667. Lab. 4 cr.

767. CASTING
Study with cast bronze and aluminum sculpture. Prereq: two 600-level studio courses in the 3-D discipline. Lab. 4 cr.

525, 526. WOODWORKING
Principles and materials of woodworking. Prereq: Arts 431 or 432 or 455. Lab. 4 cr.

625, 626. WOOD/FURNITURE DESIGN
Studio design and construction of major furniture forms. Prereq: Arts 525. Lab. 4 cr.

725. WOOD/ENVIRONMENTAL DESIGN
Topic announced before preregistration. Prereq: Arts 625, 626. Lab. 4 cr.

598. SOPHOMORE SEMINAR
See description under Two-Dimensional Courses.

695. SPECIAL PROBLEMS IN THE VISUAL ARTS
Topics and prerequisites to be announced before preregistration. May be repeated with permission of the instructor. Lab. 4 cr.

See also Arts 796 and 798.

History of Art Courses

Exemption from prerequisites by permission of instructor.

431. VISUAL STUDIES
Appreciation and understanding of the visual arts. Works from variety of periods; emphasis on style, formal analysis, methods and materials of production. For freshmen and sophomores; open to juniors and seniors by permission. 4 cr.

480. ART OF THE ANCIENT WORLD
The chief and representative monuments in architecture, sculpture, and painting from Paleolithic times to the late Roman Empire. The history of art from a broadly humanistic perspective with investigation of works such as Stonehenge, the pyramids at Giza, Mesopotamian votive figures, the Parthenon and its sculptures, and illusionistic Roman frescoes at Pompeii. 4 cr.

481. ART OF THE MIDDLE AGES
The chief and representative monuments in architecture, sculpture, and painting from early Christian times to the Gothic era. The history of art from a broadly humanistic perspective with investigation of works such as the Constantinian basilicas, Byzantine mosaics, the *Lindisfarne Gospels,* the portal sculpture of Autun, and Chartres cathedral. 4 cr.

482. ART OF THE AGE OF HUMANISM
The chief and representative monuments in architecture, sculpture, and painting from the early Florentine Renaissance to the courtly era of Louis XVI. The history of art from a broadly humanistic perspective with investigation of works such as Masaccio's frescoes, Michelangelo's *David,* the Ghent Altarpiece, the basilica of St. Peter's, Rembrandt's self-portraits, and the Georgian house in Portsmouth. 4 cr.

483. ART OF THE MODERN WORLD
The chief and representative monuments in painting, sculpture, and architecture from the Age of Reason to the present. The history of art from a broadly humanistic perspective with investigation of works such as David's revolutionary paintings, Monet's *Water Lillies,* Picasso's *Guernica,* Pollock's drip paintings, Sullivan's skyscrapers, and Rodin's *Gates of Hell.* 4 cr.

485. ARCHITECTURAL HISTORY
A survey of the chief and representative buildings from the entire history of architecture. Analysis of buildings with regard to structure, form, and symbolic content, concentrating on major works such as the pyramids, the Roman Pantheon, the Gothic cathedral, the Renaissance palace, the Baroque church, and the modern skyscraper. 4 cr.

487. THEMES AND IMAGES IN ART
Examination of one or two central ideas embodied in the artistic imagery of painting, sculpture, and architecture, covering a wide cultural spectrum. Stress on the interconnection between visual forms and the symbolic and philosophical concepts they express. A) Classicism and its Discontents; B) Nature and Culture in Art; C) Archetypes and Images; D) Major Mythic Images of Women; E) Symbols of Innocence and Experience in the New World. (May not be repeated for credit. Descriptions of sections available from the art department office.) 4 cr.

575. GREEK AND ROMAN ART
Art and architecture in ancient Greece and Rome from about 1500 B.C. through the fourth century A.D. Emphasis on classical Greek art of the fifth century B.C. and Roman Imperial art of the first and second centuries A.D. Prereq: two 400-level art history courses. 4 cr.

577. EARLY MEDIEVAL ART
The development of Christian art to include early Christian art, Byzantine art in the East and West, Coptic art, and Christian art in northern Europe to the 11th century. Architecture, painting, sculpture, and the minor arts. Prereq: two 400-level art history courses. 4 cr.

578. ROMANESQUE AND GOTHIC ART
Art in western Europe from the 11th to the 15th century: architecture, sculpture, painting, and the minor arts. Prereq: two 400-level art history courses. 4 cr.

580. NORTHERN RENAISSANCE ART
Painting, sculpture, and graphic arts in the Lowlands, Germany, Austria, and France from the 14th to the 16th century. The particularly Northern viewpoint will be considered through analysis of such major figures as van Eyck, van der Weyden, Bosch, Dürer, and Bruegel. Prereq: two 400-level art history courses. 4 cr.

582. ITALIAN RENAISSANCE ART I
Painting, sculpture, and architecture in Italy during the 14th and 15th centuries. The emergence of Renaissance style in the art of such masters as Giotto, Masaccio, Donatello, Bellini, and Piero della Francesca. Attention is also given to the broad cultural developments to which they belong. Prereq: two 400-level art history courses. 4 cr.

583. ITALIAN RENAISSANCE ART II
Continuation of Arts 582. Primary focus on the formation of High Renaissance classicism in the art of Leonardo, Michelangelo, Raphael, Bramante, and Titian. Attention is also given to the subsequent crisis of the classical ideal in 16th-century Mannerism. Prereq: two 400-level art history courses. 4 cr.

585. BAROQUE ART IN SOUTHERN EUROPE
Painting, sculpture, and architecture in Italy, France, and Spain during the 17th century. Emphasis on the diverse and innovative character of art in this period of crisis between the Renaissance and the modern era. Intensive analysis of the works of such major masters as Bernini, Caravaggio, Poussin, and Velazquez. Prereq: two 400-level art history courses. 4 cr.

586. BAROQUE ART IN NORTHERN EUROPE
Dutch and Flemish painting in the seventeenth century. Examination of such major figures as Rubens, Rembrandt, Van Dyck, and Vermeer. Attention is also given to the development of the genres and to the many "little masters" who practiced them. Prereq: two 400-level art history courses. 4 cr.

588. 19TH-CENTURY PAINTING AND SCULPTURE
Principal developments from David to Cezanne. Prereq: two 400-level art history courses. 4 cr.

589. 20TH-CENTURY PAINTING AND SCULPTURE
Principal developments from the 1890s to the 1940s. Prereq: two 400-level art history courses. 4 cr.

593. AMERICAN ART
A chronological survey of painting and sculpture in the United States from the colonial period to the present. Prereq: two 400-level art history courses. 4 cr.

594. 17TH- AND 18TH-CENTURY AMERICAN ARCHITECTURE
Chief colonial architectural styles and monuments; their relation to European antecedents. Field trips. Prereq: two 400-level art history courses. 4 cr.

595. EARLY MODERN ARCHITECTURE: REVOLUTION TO WORLD WAR I
Chief styles and monuments of American and European architecture from the "visionaries" (Ledoux, Latrobe, Jefferson) to the birth of the skyscraper and "nonhistorical" architecture. Unique American contribution to modern architectural thought. Field trips. Prereq: two 400-level art history courses. 4 cr.

596. CONTEMPORARY ARCHITECTURE: THE BUILDINGS OF OUR TIMES
Chief styles and monuments of American and European architecture from Frank Lloyd Wright and the International Style to the present. Field trips. Prereq: two 400-level art history courses. 4 cr.

597. INTRODUCTION TO NON-WESTERN ART
Survey of major art monuments of the Far East; architecture and sculpture of India; sculpture and painting in China; and architecture, painting, and prints of Japan. 4 cr. (Not offered every year.)

610. AMERICAN STUDIES: NEW ENGLAND CULTURE IN CHANGING TIMES
A team of three instructors from history, literature, and art investigate major contributions New England has made to American life. Focus on three periods: the Puritan era, 1620-90; the Transcendental period, 1830-60; and the period of emerging industrialism in the late 19th century. Prereq: second semester sophomore. (Also offered as Engl 610, Hist 610, and Huma 610.) Not for art studio major credit. 4 cr.

689. ART SINCE 1945
Tentative history of the very contemporary painting and sculpture of the New York-to-Paris art scene. Prereq: Arts 589. 4 cr.

695. SPECIAL PROBLEMS IN THE VISUAL ARTS
See description under Three-Dimensional Courses.

696. METHODS OF ART HISTORY
Essential bibliography and the methodology of research; the variety of approaches to art historical scholarship. Readings, discussion, and projects in connoisseurship, iconography, historiography, and museology. Open to advanced students with a strong art history background. Prereq (for non-art history majors): permission. 4 cr.

698. SEMINAR IN ART HISTORY
Topics and prerequisites to be announced before preregistration. May be repeated with permission of instructor. 4 cr.

699. MUSEUM STUDIES
Introduction to museum practices. History of museums: their purposes, organization, interpretation, policies, and procedures. Use of University Art Galleries, visits to other museums, lecturers. Prereq: two courses in art history and permission. 4 cr.

See also Arts 796.

Art Education Courses

All courses elective by permission of the Department of the Arts.

791. ART EDUCATION
Philosophy, objectives, and methods of the teaching of the visual arts, grades K-12. Lab. 4 cr.

See also Arts 796.

Biochemistry (Bchm)

(For program description, see page 41)

CHAIRPERSON: James A. Stewart
PROFESSORS: Donald M. Green, Edward J. Herbst, Miyoshi Ikawa, Samuel C. Smith, James A. Stewart
ASSISTANT PROFESSORS: Clyde L. Denis, James B. Matthew

501. BIOLOGICAL CHEMISTRY
Includes an introduction to organic chemistry. Prereq: one semester of chemistry or equivalent. Students receiving credit for Bchm 501 may not receive credit for Bchm 601. Lab. 4 cr.

601. GENERAL BIOCHEMISTRY
General principles. Prereq: organic chemistry. Students receiving credit for Bchm 601 may not receive credit for Bchm 501. Lab. 4 cr.

656. PHYSIOLOGICAL CHEMISTRY AND NUTRITION
Mammalian biochemistry with emphasis on the human. Lab study includes procedures basic to chemical methods of medical diagnosis. Prereq: organic chemistry. Lab. 4 cr.

699. SENIOR THESIS
Research in biochemistry for senior majors. 2 cr.

702. COMPARATIVE MARINE BIOCHEMISTRY
Nutrition, metabolism, and composition of marine organisms and relation to phylogeny; marine natural products. Prereq: Bchm 601 or equivalent. 3 cr. (Alternate years, offered 1983-84.)

721. NEUROCHEMISTRY
Biochemistry of the nervous system; metabolism and alterations of normal brain chemistry by drugs, chemicals, nutrition, memory, and learning; pathological changes. Prereq: a biochemistry course. 3 cr. (Alternate years, offered 1984-85.)

751-752. PRINCIPLES OF BIOCHEMISTRY
Fundamental biochemistry; chemistry, metabolism, and biological function of nucleic acids, proteins, carbohydrates, and lipids. Prereq: organic chemistry or permission. Lab. 4 cr.

760. ENZYME CHEMISTRY
Structure, properties, and function of enzymes; kinetics and mechanisms of enzyme-catalyzed reactions; purification, characterization, and assay of enzymes. Prereq: Bchm 601 or 751. Lab. 4 cr. (Alternate years, offered 1984-85.)

771. BIOCHEMICAL GENETICS
Mechanisms of storage, replication, transmission, transcription, recombination, mutation, and expression of genetic information by cells and viruses. Prereq: Bchm 751 or permission. (Also offered as Gen 771.) 3 cr.

772. INTRODUCTORY LABORATORY IN MOLECULAR GENETIC TECHNIQUES
Modern biochemical gene manipulation techniques including the genetic, physical, and enzymatic characterization of gene vectors, gene cloning, construction of genetic probes, and sequencing of nucleic acids. Prereq: Bchm 751-752; Bchm 771 or Bchm 781 or Micr 804. (Also offered as Gen 772.) 2 cr.

781. THE NUCLEIC ACIDS
Chemistry and metabolism of nucleic acids; molecular structures, purification and separation, biosynthesis, and biological functions. Prereq: organic chemistry; biochemistry. 3 cr.

789. SPECIAL TOPICS IN BIOCHEMISTRY
Seminars by guest speakers in selected areas of biochemistry. 2 cr. Cr/F. (Not offered every year.)

795, 796. INVESTIGATIONS IN BIOCHEMISTRY
Prereq: permission. Subject matter and hours to be arranged. 2 cr.

Biology (Biol)

(For program description, see page 80)

See additional course descriptions under Animal Sciences, Biochemistry, Botany and Plant Pathology, Entomology, Forest Resources, Microbiology, Plant Science, and Zoology.

401. HUMAN BIOLOGY
Elementary study of structure, function, and development of all systems of the body. No credit toward major or minor. Cannot be taken for credit after Zool 507-508. 4 cr.

402. MAN AND HIS ENVIRONMENT
Basic interrelationships between organisms and populations and their environments; ecosystems; man's modification of his environment and its consequences. No credit toward a major or minor. Students with credit for Biol 541 cannot receive credit for Biol 402. 4 cr.

403. THE LIVING WORLD
General survey of plant and animal kingdoms; elementary principles of heredity, evolution, and ecology. No credit toward a major or minor. 4 cr.

409. HUMAN REPRODUCTIVE BIOLOGY
Aspects of human sexuality from anatomical, physiological, and other viewpoints. No credit toward a major or minor. 4 cr.

420. MAN, NATURE, AND DISEASE
Ecology of human disease; role of disease in history; biological, social, and economic problems involved in eradication and control. Particular attention to diseases that still account for serious sickness and mortality in overpopulated, underdeveloped countries. No credit toward a major or minor. 4 cr.

541. GENERAL ECOLOGY
Interrelationships between organisms and their physical environment; populations, communities, the ecosystem, energy flow. Prereq: introductory chemistry; Bot 411 or 412; Zool 412; /or equivalent. 4 cr.

543. FIELD ECOLOGY
Consideration of ecological principles by inquiry in natural habitats and in the laboratory. Prereq: Math 425, statistics, or equivalent; present or prior enrollment in Biol 541; permission. Lab. 2 cr.

791. PROBLEMS IN THE TEACHING OF HIGH SCHOOL BIOLOGY
Objectives and methods; selection and organization of materials, preparation of visual aids and other projects; use of field trips. Prereq: two years of biological science; permission. 4 cr.

Botany and Plant Pathology (Bot)

(For program description, see page 41)

CHAIRPERSON: Subhash C. Minocha
PROFESSORS: Arthur C. Mathieson, Richard W. Schreiber
ASSOCIATE PROFESSORS: Alan L. Baker, Robert O. Blanchard, A. Linn Bogle, Garrett E. Crow, Leland S. Jahnke, William E. MacHardy, Subhash C. Minocha
ASSISTANT PROFESSOR: Thomas D. Lee
ADJUNCT PROFESSOR: Alex L. Shigo
ADJUNCT ASSISTANT PROFESSOR: Walter C. Shortle

411. GENERAL BOTANY
Introduction to plant biology. Evolution of structure and function in the plant kingdom. Equivalent to Bot 412. Cannot be taken for credit if credit received for Bot 412. $5 lab fee. Lab. 4 cr.

412. INTRODUCTORY BOTANY
All groups of plants; growth, development, and environmental responses. Equivalent to Bot 411. Cannot be taken for credit if credit received for Bot 411. $5 lab fee. Lab. 4 cr.

503. THE PLANT WORLD
Survey of the plant kingdom. The biology and economic significance of the major groups of plants; the major trends of evolutionary specialization in the form, structure and function, and the interrelationships of the major divisions. Lab. 4 cr.

566. SYSTEMATIC BOTANY
Scientific basis of plant taxonomy and the identification and classification of major plant families, native trees, shrubs, and wild flowers. Prereq: one semester of biological science. Lab. 4 cr.

601. TERRESTRIAL PLANT ECOLOGY
Regulation of distribution and abundance of terrestrial plants by physical and biotic environmental factors; ecology of plant life history patterns; development and structure of plant communities; ecosystem structure and function. Occasional Saturday field trips. Prereq: Bot 411 or 412, or equivalent with permission. Lab. 4 cr.

606. PLANT PHYSIOLOGY
Structure and function in higher plants: water relations, metabolism, growth, and development. Prereq: Bot 411 or 412 or 503 or PlSc 421; one year of chemistry; /or permission. Lab. 4 cr.

625. INTRODUCTION TO MARINE BOTANY
Life history, classification, and ecology of micro- and macroscopic marine plants, including phytoplankton, seaweed, and salt marsh plants, and the interactions between man and marine plant communities. Occasional Saturday morning field trips. Prereq: Bot 411 or 412; a semester of biology; /or permission. Lab. 4 cr. (Summer Session only.)

658. PLANT ANATOMY
Anatomy of vascular plants, emphasizing structure and development of basic cell and tissue types, and of the major plant organs. Prereq: Bot 411 or 412 or 503. Lab. 4 cr. (Alternate years, offered 1984-85.)

666. SUMMER FLORA OF NEW HAMPSHIRE
Study of the flora of New Hampshire with an in-depth look at the major vegetation types. Field work will include trips to study flora of forests, dunes, salt marshes, swamps, bogs, lakes, ponds, streams, and alpine. Prereq: basic botany or permission. 4 cr. (Summer Session only.)

717. GENERAL LIMNOLOGY
Special relationships of freshwater organisms to the chemical, physical, and biological aspects of their environment; factors regulating their distribution; and the primary and secondary productivity of lakes. Prereq: Biol 541 or equivalent. 4 cr.

719. FIELD LIMNOLOGY
Principles of freshwater ecology examined in a variety of habitats; application of field instruments and computer methods used to study lakes and interpret data. Occasional Saturday field trips. Prereq: prior or concurrent enrollment in Bot 717; permission. Lab. 4 cr.

721. THE MICROSCOPIC ALGAE
Survey of phytoplankton and periphyton in local marine and freshwater habitats. Identification, systematics, and evolution. Class and individual collection trips. Prereq: Bot 411 or 412 or 503. Lab. 4 cr.

722. MARINE PHYCOLOGY
Identification, classification, ecology, and life histories of the major groups of marine algae, particularly the benthonic marine algae of New England. Periodic field trips. Prereq: Bot 411 or 412 or 503. Lab. 4 cr. (Alternate years, offered 1983-84.)

723. MARINE ALGAL ECOLOGY
Distribution, abundance, and growth of marine plants in relation to their environment. Scheduled field trips and an independent research project are required. Prereq: Bot 722 or Zool 715 or permission. Lab. 4 cr. (Alternate years, offered 1984-85.)

724. FRESHWATER ALGAL ECOLOGY
Survey of freshwater algal habitats; physiological explanation of population models. Individual experimental projects. Prereq: Bot 717 or 721 or permission. 4 cr.

727. ALGAL PHYSIOLOGY
A survey of major topics in the physiology and biochemistry of marine and freshwater algae including: nutrition, metabolic pathways, reproductive physiology, storage and extracellular products, cell inclusions, growth and development. Prereq: plant physiology and introductory biochemistry or permission. 2 cr. (Alternate years, offered 1983-84.)

729. ALGAL PHYSIOLOGY LABORATORY
Useful laboratory techniques in studying the physiology of freshwater and marine algae. Experiments in nutrition, metabolism, pigment and enzyme analysis. Small research project required. Prereq: concurrent registration in Bot 727; permission. 2 cr. (Alternate years, offered 1983-84.)

730. MORPHOGENESIS
Principles of differentiation; internal and external factors in cellular and organismic development. Prereq: Bot 606 or permission. 4 cr. (Alternate years, offered 1984-85.)

732. CELL BIOLOGY
Structure, behavior, and development of cells; the cellular basis of heredity. Prereq: one year of biological science and chemistry. 4 cr.

742. PHYSIOLOGICAL ECOLOGY
Physiological responses of plants to the physical environment; energy exchange, light and photosynthesis, water relations, and mineral nutrition. Prereq: Bot 606 or permission. Lab. 4 cr.

747. AQUATIC HIGHER PLANTS
Flowering plants and fern relatives found in and about bodies of water in the northeastern United States; extensive field and herbarium work, preparation techniques, and collections. Prereq: Bot 566. Lab. 4 cr. (Alternate years, offered 1984-85.)

751. PLANT PATHOLOGY
Nature, symptomatology, etiology, classification, and control of important plant diseases. Prereq: Bot 411 or 412 or equivalent. Lab. 4 cr.

752. MYCOLOGY
Parasitic and saprophytic fungi; growth, reproduction, and identification; preparation of pure cultures. Prereq: Bot 411 or 412 or equivalent. Lab. 4 cr.

753. FOREST AND SHADE TREE PATHOLOGY
Principles, symptomatology, etiology, and control of forest and shade tree diseases. Prereq: Bot 411 or 412 or equivalent. Lab. 4 cr.

754. PRINCIPLES OF PLANT DISEASE CONTROL
Epidemiology of plant diseases and relationships to cultural practices, resistant varieties, biological control and chemical control; crop loss assessment; disease forecasting; disease pest management. Prereq: Bot 751 or 753. Lab. 4 cr. (Alternate years, offered 1984-85.)

761. PLANT GEOGRAPHY
Distribution of plants, a consideration of world vegetation types and floras, and problems of endemism with emphasis on North America; major influential factors such as geologic, climatic, edaphic, and biotic. Three Saturday field trips. Prereq: Bot 566 or permission. 4 cr. (Alternate years, offered 1983-84.)

762. MORPHOLOGY OF SEED PLANTS
Comparative form and structure of the major living and extinct groups; evolutionary modifications of the vegetative and reproductive organs, and the basic life history pattern. Prereq: Bot 503. Lab. 4 cr. (Alternate years, offered 1983-84.)

764. MICROTECHNIQUE
Methods of preserving cell and tissue structure, embedding, sectioning, and staining plant tissues, and an introduction to microscopy. Prereq: permission. Lab. 4 cr. (Alternate years, offered 1984-85.)

795-796. INVESTIGATIONS IN:
A) Systematic Botany; B) Plant Physiology; C) Plant Pathology; D) Plant Anatomy; E) Plant Ecology; F) Mycology; G) Cell Biology; H) Phycology; I) Botanical Teaching; J) Morphology; K) Cell Physiology; L) Scientific Writing; M) Microtechnique; N) Optical Microscopy; O) History of Botany. Individual projects under faculty guidance. Elective only with permission. 1-4 cr.

Chemical Engineering (ChE)

(For program description, see page 53)

CHAIRPERSON: Stephen S. T. Fan
PROFESSORS: Stephen S. T. Fan, Gael D. Ulrich
ASSOCIATE PROFESSORS: Ihab H. Farag, Virendra K. Mathur, Donald C. Sundberg
ASSISTANT PROFESSOR: Arun Someshwar
FACULTY IN RESIDENCE: Subodh Ganguly

410. SURVEY OF CURRENT ENERGY AND POLLUTION CONTROL TECHNOLOGY
Energy supply in this country and the world; conventional fuel reserves: coal, oil, natural gas; alternative sources: nuclear, solar, geothermal, etc. Forecasts and strategies to meet needs. Environmental pollution, sources, and economic and environmental impacts. Methods for pollution control. Regulatory standards for environmental protection. Prereq: good background in high school chemistry. 4 cr.

501. INTRODUCTION TO CHEMICAL ENGINEERING I
Overview of the profession. Systems of units; material balances and chemical reactions; gas laws; phase phenomena. 3 cr.

502. INTRODUCTION TO CHEMICAL ENGINEERING II
Energy and material balances for simple and complex systems with and without chemical reactions. 3 cr.

601. FLUID MECHANICS AND UNIT OPERATIONS
Continuity, momentum, and energy equations; laminar and turbulent flow in pipes; rheology. Applications to flow in porous media, filtration, and fluidization. 3 cr.

602. HEAT TRANSFER AND UNIT OPERATIONS
Thermal properties of materials, steady-state and transient conduction and convection; radiation; applications to heat exchangers and process equipment. 3 cr.

603. APPLIED MATHEMATICS FOR CHEMICAL ENGINEERS
Mathematical modeling and analysis of chemical engineering problems. Analytical methods for first- and second-order differential equations; numerical solutions; series solutions; Bessel functions; Laplace transforms; matrix algebra. Interpretation and solution of partial differential equations. Prereq: knowledge of FORTRAN programming. Lab. 4 cr.

604. CHEMICAL ENGINEERING THERMODYNAMICS
Volumetric and phase behavior of ideal and real gases and liquids; cycles; steady-flow processes; chemical equilibrium. Lab. 4 cr.

605. MASS TRANSFER AND STAGEWISE OPERATIONS
Diffusion in gases, liquids, and solids; design and analysis of distillation, absorption, adsorption, extraction, and other stagewise equipment and operations. 3 cr.

606. CHEMICAL ENGINEERING KINETICS
Use of laboratory data to design commercial reactors. Continuous, batch, plug-flow, and stirred-tank reactors for homogeneous and catalytic multiphase reactions. 3 cr.

608. CHEMICAL ENGINEERING DESIGN
Introduction to cost engineering. Application of acquired skills to design of chemical processes. Individual, major design project required. Lab. 3 cr.

609. FUNDAMENTALS OF AIR POLLUTION AND ITS CONTROL
Sources, pollutant transfer, and effects. Regulatory, administrative, legal, and social aspects; engineering control. 4 cr.

612. CHEMICAL ENGINEERING LABORATORY I
Selected experiments in fluid mechanics, heat transfer, and unit operations. 2 cr.

613. CHEMICAL ENGINEERING LABORATORY II
Selected experiments in mass transfer, stagewise operations, thermodynamics, and kinetics. 2 cr.

695. CHEMICAL ENGINEERING PROJECT
Independent research problems carried out under faculty supervision. 2-4 cr.

696. INDEPENDENT STUDY
Prereq: permission of the adviser and department chairperson; granted only to students having superior scholastic achievement. 1-4 cr.

701. INTRODUCTION TO POLYMER ENGINEERING
Principles of polymer chemistry, polymerization kinetics, polymer rheology, and material characteristics. Design and analysis of polymer reactors, extruders, molding machines, and other forming operations. Lab. 4 cr.

705. NATURAL AND SYNTHETIC FOSSIL FUELS
Study of U.S. and foreign reserves of coal, oil, and natural gas. Petroleum processing and refining. Coal, oil shale, and tar sand. Gasification and liquefaction of coal. Lab. 4 cr.

712. INTRODUCTION TO NUCLEAR ENGINEERING
Development of nuclear reactors; binding-energy; radioactivity; elements of nuclear reactor theory; engineering problems of heat transfer, fluid flow, materials selection, and shielding; environmental impacts. 4 cr.

751. PROCESS SIMULATION AND OPTIMIZATION
Techniques for computer-aided analysis of chemical processing systems. Development of mathematical models to describe process behavior. Application of optimization techniques. Prereq: a knowledge of FORTRAN programming. Lab. 4 cr.

752. PROCESS DYNAMICS AND CONTROL
Dynamic behavior of chemical engineering processes described by differential equations; feedback control concepts and techniques; stability analysis. Lab. 4 cr.

772. PHYSICOCHEMICAL PROCESSES FOR WATER AND AIR QUALITY CONTROL
Origin and characterization of pollutants. Controls, including filtration, sedimentation, coagulation and flocculation, absorption and adsorption. Applied fluid mechanics, mass transfer, and kinetics. Thermal pollution, chemical treatment, oil spills on water, and aeration. Lab. 4 cr.

Chemistry (Chem)

(For program description, see page 54)

CHAIRPERSON: Frank L. Pilar
PROFESSORS: Alexander R. Amell, Kenneth K. Andersen, N. Dennis Chasteen, Clarence L. Grant, Colin D. Hubbard, Paul R. Jones, James D. Morrison, Charles W. Owens, Frank L. Pilar, Albert K. Sawyer, James H. Weber, Charles M. Wheeler, Jr.
ASSOCIATE PROFESSOR: W. Rudolf Seitz
ASSISTANT PROFESSORS: Christopher F. Bauer, Gary R. Weisman, Edward H. S. Wong
FACULTY IN RESIDENCE: Louise H. Foley, Clive E. Holloway, Sachiko I. Howard

*401-402. INTRODUCTION TO CHEMISTRY
Elementary, broad view of chemistry; emphasizes topics related to everyday life. For students who do not intend to take any other chemistry courses, and those interested in satisfying a science requirement. Not a prerequisite for any other chemistry courses. Lab. 4 cr.

*403-404. GENERAL CHEMISTRY
Fundamental laws and concepts applied to nonmetals, metals, and their compounds. For students

* Students may receive credit for only one course from 401, 403, 405, and 409, and for only one course from 402, 404.

who plan to take further chemistry courses. Previous chemistry recommended. Knowledge of algebra, exponentials, and logarithms required. Lab. 4 cr.

*405. GENERAL CHEMISTRY
Basic principles; atomic structure, bonding, equilibria, and thermodynamics. First course for chemistry majors. Prereq: one year of high school chemistry, algebra, and knowledge of exponentials and logarithms. Restricted to chemistry, biochemistry, physics, chemical engineering, and mechanical engineering majors. Cannot be taken for credit if credit received for Chem 403-404. Lab. 4 cr. (Honors lab available with permission.)

406. QUANTITATIVE ANALYSIS
Studies of pollution, environmental problems, and the more traditional professional work in chemistry rely heavily on a sound knowledge of analytical chemistry. Gravimetric and volumetric analysis, potentiometry, spectrophotometry, and selected separations methods. Prereq: Chem 404 or 405. Coreq: Chem 407. 3 cr.

407. QUANTITATIVE ANALYSIS LABORATORY
Gravimetric and volumetric analysis; chemical separations; potentiometry and spectrophotometry. Treatment of data, error analysis, and calculation of results. Coreq: Chem 406. 2 cr.

*409. CHEMISTRY, MAN, AND SOCIETY
Elementary survey of chemistry; integrates principles and applications. For students who do not intend to take any other chemistry courses and those interested in satisfying a science requirement. Not a prerequisite for any other chemistry course. Lab. 4 cr.

517. QUANTITATIVE ANALYSIS
For students planning careers in medicine, dentistry, plant and animal science, nursing, oceanography, and environmental science. Volumetric methods, separations, and instrumental methods. Prereq: Chem 404 or 405. Coreq: Chem 518. 3 cr.

518. QUANTITATIVE ANALYSIS LABORATORY
Volumetric methods with an emphasis on technique; separations; and selected instrumental methods such as potentiometry, spectrophotometry, atomic absorption, and gas chromatography. Coreq: Chem 517. 2 cr.

545. ORGANIC CHEMISTRY
Introductory study of carbon compounds for those who desire a brief terminal course. Prereq: Chem 404 or 405. Coreq: Chem 546. Students receiving credit for Chem 545 may not receive credit for Chem 402, 547-548, or 651-652. 3 cr.

546. ORGANIC CHEMISTRY LABORATORY
Must be taken concurrently with 545. 2 cr.

547-548. ORGANIC CHEMISTRY
Principal classes of organic compounds, aliphatic and aromatic; class reactions and structural theory. Intended primarily for chemistry, chemical engineering, and biochemistry majors. Prereq: Chem 404 or 405; /or permission. Coreq: Chem 549-550. Students receiving credit for Chem 547-548 may not receive credit for either Chem 545 or 651-652. 3 cr.

549-550. ORGANIC CHEMISTRY LABORATORY
Must be taken concurrently with 547-548. Lab. 2 cr.

651-652. ORGANIC CHEMISTRY
Principal classes of organic compounds, aliphatic and aromatic, class reactions and structural theory. Intended primarily for pre-healing arts, biological science, and health science students. Prereq: Chem 404 or 405; /or permission. Coreq: Chem 653-654. Students receiving credit for Chem 651-652 may not receive credit for either Chem 545 or 547-548. 3 cr.

653-654. ORGANIC CHEMISTRY LABORATORY
Must be taken concurrently with 651-652. 2 cr.

663. INTRODUCTORY RADIOCHEMICAL TECHNIQUES
Techniques and laboratory practice in the use of apparatus in many fields of science employing radiochemical operations. Prereq: general inorganic chemistry and general physics. Lab. 4 cr. (Not offered every year.)

683-684. PHYSICAL CHEMISTRY I, II
The properties of gases, liquids, and solids; thermochemistry and thermodynamics; solutions, chemical equilibria, reaction rates, conductance, and electromotive force. Prereq: Math 426; pre- or coreq: Phys 407 or 402. Undergraduates must register for 685-686 concurrently. 3 cr.

685-686. PHYSICAL CHEMISTRY LABORATORY
Measurement of thermodynamic properties, chemical kinetics, and methods of determining the structure of matter. Prereq: Math 426; pre- or coreq: Phys 407 or 402. Undergraduates must register for 683-684 concurrently. 2 cr.

696. INDEPENDENT STUDY
For exceptional students. Individual reading, writing, or laboratory work carried out under the tutelage of a faculty member. The course may be used to replace specific required courses in chemistry. Prereq: approval of the adviser and department chairperson. Credits to be arranged.

697. CHEMICAL LITERATURE
The chemistry library as a research tool. Prereq: Chem 548 or 652. 1 cr.

698. SEMINAR
Student reports on topics of interest. Prereq: Chem 548 or 652; Chem 684. 1 cr.

699. THESIS
Year-long investigation in a selected topic, with background and experimental investigation. For chemistry majors who have completed Chem 548, 762, 684. Required for B.S. chemistry majors. Strongly recommended for B.A. chemistry majors. (2.50 average or permission required.) Lab. 4 cr.

708. RESEARCH TECHNIQUES
Lectures and laboratory to show experimental methods and interpretation of results. Typical topics are chromatography, data handling, nuclear magnetic resonance, mass spectrometry, elementary electronics, infrared and ultraviolet spectroscopy, experimental design, and X-ray. 1-4 cr.

755. ADVANCED ORGANIC CHEMISTRY
Methods of synthesis and determination of structure, including stereochemistry of complex organic compounds. Prereq: Chem 548 or 652 or equivalent. Chem majors must register for 756 concurrently. 3 cr.

756. ADVANCED ORGANIC CHEMISTRY LABORATORY
Synthesis and structural determination of complex organic compounds, techniques for the separation, determination of purity, and identification of compounds by spectroscopic and chemical means. Must be taken concurrently with 755 by Chem majors. 2 cr.

762. INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS
Theory, instrumentation, and application of methods such as atomic absorption, coulometry, emission spectrography, gas and liquid chromatography, polarography, potentiometry, IR and UV-VIS absorption spectrophotometry, and mass spectrometry to chemical analysis. Prereq: Chem 406 or 517; Chem 684 as a pre- or corequisite; /or permission. Coreq: Chem 763. 3 cr.

763. INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS LABORATORY
Experimental parameters, error analysis, and applications of the methods covered in Chem 762. Coreq: Chem 762. 2 cr.

774. INORGANIC CHEMISTRY
Basic theoretical concepts and their applications to inorganic reactions and compounds. Prereq: Chem 683; Chem 684 pre- or corequisite; /or permission. Undergraduates must take 775 concurrently. 3 cr.

775. INORGANIC CHEMISTRY LABORATORY
Synthesis and characterization of inorganic compounds with an emphasis on techniques not taught in other laboratory courses. Undergraduates must take 774 concurrently. 2 cr.

776. PHYSICAL CHEMISTRY III
Application of quantum theory to atomic electron structure, spectroscopy, and molecular structure. Prereq: Chem 683-684. Lab. 4 cr.

778. CHEMISTRY OF LARGE MOLECULES
Basic chemistry of high-molecular-weight compounds, including synthetic polymers and substances occurring in living systems. Elementary aspects of the structures, syntheses, and properties of large molecules, and their roles in modern science, technology, and living systems. Prereq: one semester of organic chemistry. 4 cr.

Civil Engineering (CiE)

(For program description, see page 55)

CHAIRPERSON: Paul J. Ossenbruggen
PROFESSORS: Paul L. Bishop, Otis J. Sproul, Tung-Ming Wang
ASSOCIATE PROFESSORS: Pedro A. De Alba, Charles H. Goodspeed, David L. Gress, Louis H. Klotz, Paul J. Ossenbruggen
ASSISTANT PROFESSORS: Robert M. Henry, Windsor Sung
ADJUNCT ASSOCIATE PROFESSORS: Gerald Batchelder, John A. Olofsson, Jr.

400. CIVIL ENGINEERING LECTURES
Introduction to the profession; the civil engineer as a planner, builder, and problem solver; and the goals of the civil engineering curriculum. Lectures by faculty and visitors. Required of CiE freshmen; open to others by permission. 0 cr. Cr/F.

505. SURVEYING
Land measurements by ground and photogrametric methods. Application of error theory to planning and adjusting engineering surveys. Conformal mapping and its applications to state plane coordinate systems. Coreq: Math 426 or permission. Lab. 4 cr.

525. MECHANICS I
An introduction to statics. Two- and three-dimensional force systems, the concept of equilibrium, analysis of trusses and frames, centroids, bending moment and shear force diagrams, friction, and virtual work. Prereq: Math 425; Math 426; Phys 407. 3 cr.

526. MECHANICS II
An introduction to strength of materials. Analysis of members under torsion, axial, shear, and bending stresses; superposition of stresses; stability of columns. Prereq: CiE 525. 3 cr.

527. MECHANICS III
An introduction to particle and rigid body dynamics. Rectilinear and curvilinear motion, translation and rotation, momentum and impulse principles, and work-energy relationships. Prereq: CiE 525 or permission. 3 cr.

621. TRANSPORTATION PLANNING AND DESIGN
Determining public transportation needs. Planning; the comparison and evaluation of alternative system modifications. Analysis of impacts of transportation facilities. Geometric design and traffic capacity of highways. Prereq: CiE major or permission. 3 cr.

622. ENGINEERING MATERIALS
Structural properties and applications of the various materials used in civil engineering work, including steel, cement, mineral aggregates, concrete, timber, and bituminous materials. Micro-structure and properties of common metals, plastics, and ceramics. Prereq: CiE 526. Lab. 4 cr.

642. FLUID MECHANICS
Properties of fluids, fluid statics, continuity, momentum and energy equations, flow resistance. Measurement of fluids. Prereq: CiE 527. Lab. 4 cr.

643. ENGINEERING ASPECTS OF ENVIRONMENTAL POLLUTION CONTROL
An introduction to the causes and effects of environmental pollution. The application of fundamental concepts of mass and energy balance in the design and description of pollutant flow and control. The physical, chemical, and biological aspects of pollution control will be discussed. The economic and legislative aspects of pollution control will also be addressed briefly. Prereq: Chem 403-404; Math 425; 426; 527. 3 cr.

644. WATER AND WASTEWATER ENGINEERING
Fundamental design concepts for operations and processes used in water treatment and water pollution control. Prereq: CiE 643. 3 cr.

665. SOIL MECHANICS
Soil classification and physical properties. Permeability, compressibility, bearing capacity, settlement, and shear resistance are related to the behavior of soils subjected to various loading conditions. Prereq: CiE 622. Lab. 4 cr.

681. STRUCTURAL ANALYSIS
Analytical stress and deflection analysis of determinate structures under static and moving load. Computer solution of beams and trusses by classical and matrix methods. Prereq: CiE 525-526. 3 cr.

682. PROJECT PLANNING AND DESIGN
Student groups will be formed into design teams to prepare a design plan for a large scale civil engineering system including consideration of budgetary contraints, building code criteria, and environmental impacts. A final written and oral report will be prepared by each team. Prereq: senior CiE major. 4 cr.

685. INDETERMINATE STRUCTURES
Analysis of indeterminate structures; nonprismatic members subject to static and moving loads. Solution by classical, numerical, and computer-applied methods. Prereq: CiE 681. 4 cr.

695. CIVIL ENGINEERING PROJECTS
Independent research, under faculty guidance, of a subject of particular interest to an individual or a small group. Prereq: approval of faculty member involved. 2-4 cr.

701. ADVANCED SURVEYING
Instrumental and analytical photogrammetry. Conformal mapping and its application to the state plane coordinate systems. Geodetic surveying. Error theory and its application to the planning and adjustment of surveys. Application of electronic computers to surveying calculations. Prereq: CiE 505. Lab. 4 cr.

714. CONTRACTS, SPECIFICATIONS, AND PROFESSIONAL RELATIONS
Essential elements and legal requirements of engineering contracts; purposes and content of specifications; professional conduct, relations, registration, and ethics. Construction planning and management; cost analysis based on quantity surveys and unit-cost methods. Prereq: permission. 3 cr.

721. PAVEMENT DESIGN
Flexible and rigid pavements and bases for highways, airports, and city streets; pavement selection, construction methods, materials, specifications, and engineering cost estimates. Prereq: CiE 665. 3 cr.

722. PROPERTIES AND PRODUCTION OF CONCRETE
Basic principles of hydraulic cements and mineral aggregates, and their interactions in the properties of plastic and hardened concrete; modifications through admixtures; production handling and placement problems; specifications; quality control and acceptance testing; lightweight, heavyweight, and other special concretes. Prereq: CiE 622 or permission. 3 cr.

723. BITUMINOUS MATERIALS AND MIXTURES
Considerations of major types of bituminous materials, asphalt cements, cutback asphalts, asphalt emulsions, and tars; influence of chemical composition on physical properties; desirable aggregate characteristics for bituminous mixtures; construction techniques; current practices for determining optimum asphalt contents. Prereq: CiE 622 or permission. 3 cr.

731. NETWORK PLANNING AND SCHEDULING
Application of critical path methods (CPM) and project evaluation review technique (PERT) to the design and control of engineering projects. Lab. 2 cr.

733. SYSTEMS ANALYSIS I
Quantitative and economic techniques for optimum allocation of resources in planning and design of engineering systems. Topics include engineering economics, principles of optimization, matrix methods, linear programming, and linear regression methods. Prereq: senior CiE major. 3 cr.

734. SYSTEMS ANALYSIS II
A continuation of Systems Analysis I. More advanced topics of systems analysis will be introduced. Topics include nonlinear programming, numerical methods, and linear regression analysis. Application to the optimum design of structures, treatment plants, and other large scale facilities. Prereq: CiE 733. 3 cr.

740. RURAL WASTEWATER ENGINEERING
Methods for collecting and treating wastewater in small communities and rural areas. Biological and physicochemical treatment systems for small communities; land application; soil absorption; gray water treatment; and septage treatment. Prereq: CiE 643. 3 cr.

741. OPEN CHANNEL FLOW
Energy and momentum principles in open channel flow; flow resistance; channel controls and transitions; unsteady open channel flows; convective and dispersive transportation of pollutants; and basic modeling techniques. Prereq: CiE 642. 3 cr.

743. ENVIRONMENTAL SAMPLING AND ANALYSIS
Laboratory exercises in the techniques of water, wastewater, and solid-waste sampling and analysis. Interpretation of results from pollution surveys and operation of pollution control facilities; statistics of sampling and statistical evaluation of analytical data. Prereq: Chem 403-404. Lab. 3 cr.

744. ENVIRONMENTAL LIMNOLOGY
Biological, chemical, and physical processes that occur in lakes and impoundments are explored and interpreted with respect to the cultural activities of man. Basic concepts of lake origin, morphometric and trophic status, water movement and stratification, nutrient cycling, and others. Current limnologically related problems are explored from the environmental engineering standpoint. Term proj-

ects involving laboratory and fieldwork, and readings in the current scientific literature are required. Lab. 4 cr.

745. HYDROLOGY AND HYDRAULICS
Occurrence and physical effects of water on the earth; meteorology, groundwater runoff and stream-flow routing, open-channel flow, reservoirs, control works, hydroelectric power, irrigation, drainage, and multipurpose projects. Prereq: CiE 642. 3 cr.

746. WASTEWATER TREATMENT PLANT DESIGN
Choice of treatment units. Design of the components; preparation of a plan for a particular city that includes a suitable combination of the units previously designed. Prereq: CiE 644. 3 cr.

747. INTRODUCTION TO MARINE POLLUTION AND CONTROL
Introduction to the sources, effects, and control of pollutants in the marine environment. Dynamic and kinetic modeling; ocean disposal of on-shore wastes, shipboard wastes, solid wastes, dredge spoils, and radioactive wastes; and oil spills. Prereq: CiE 644 or permission. 3 cr.

748. SOLID WASTE MANAGEMENT
Basic concepts and theories of solid waste management systems, including collection and disposal methods. Incineration, sanitary landfill design, etc.; resource recovery techniques; hazardous waste management. Prereq: CiE 643 or permission. 3 cr.

749. WATER CHEMISTRY
The application of chemical principles to the interpretation of water quality criteria and parameters and the use of chemistry in water and wastewater treatment will be discussed. The theory, applications, and the calculations of ionic equilibrium will be stressed. Major topics covered include acid/base, hydrolysis, complexation, precipitation/dissolution, and redox equilibria. The applicability of such results and kinetic principles to natural water chemistry will also be briefly discussed. Prereq: Chem 403-404; or equivalent. 3 cr.

751. TRANSPORTATION PLANNING
Transportation demand forecasting techniques applied to regional and urban situations. Calibration and use of mathematical models for forecasting land use, trip generation, trip distribution, modal choice, and trip assignment. Prereq: Math 644. 3 cr.

757. COASTAL ENGINEERING AND PROCESSES
Introduction to small amplitude and finite amplitude wave theories. Wave forecasting by significant wave and wave spectrum method. Coastal processes and shoreline protection. Wave forces and wave-structure interaction. Introduction to mathematical and physical modeling. Prereq: CiE 642 or permission. 3 cr.

763. ADVANCED SOIL MECHANICS I
Current methods of determining soil strength and compressibility. Application to earth pressure, bearing capacity, slope stability, and settlement problems. Prereq: CiE 665. 3 cr.

765. FOUNDATION ENGINEERING
Subsurface investigation, excavation problems. Selection of foundation type. Design of footings, rafts, pile foundations, bulkhead walls. Prereq: CiE 682; CiE 763. 3 cr.

766. GEOLOGICAL ENGINEERING
The influence of geology in the design of foundations, underground excavations, tunnels, dams, and highways. Includes engineering properties of rocks, rock mechanics, and tunneling. Prereq: CiE 665 or permission. 3 cr.

768. SEEPAGE ANALYSIS AND EARTH DAM DESIGN
Groundwater flow, Darcy's law, flow nets, analytical techniques, Dupuit's theory, confined flow, flow through earth and rock structures, seepage toward wells, and earth dam design. Prereq: CiE 642; CiE 665. 3 cr.

782. TIMBER DESIGN
Properties and characteristics of structural woods, mechanics of wood, connection methods, design of timber members, and connections in beams, columns, and trusses, and glued laminates of wood. Prereq: CiE 682; permission. 2 cr.

784. STRUCTURAL ANALYSIS BY MATRIX AND NUMERICAL METHODS
Unifying concept of basic structural analysis theories; matrix and numerical methods of analysis, and their application by linear graph concepts using computers. Prereq: CiE 685. 3 cr.

785. INTRODUCTION TO STRUCTURAL VIBRATIONS
Dynamic analysis of single- and multi-degree-of-freedom systems. Simple beam and frame structures. Earthquake analysis and design. Co- or prereq: CiE 685. 3 cr.

786. FINITE ELEMENT APPLICATIONS FOR SOLID MECHANICS
Introductory course in the use of finite element methods for solution of various solid mechanics problems. Topics include basic matrix theory, direct stiffness method of structural analysis, development of finite element theory, and modeling engineering problems with finite element modules. Prereq: CS 410; CiE 685 or permission. 3 cr.

791. PRESTRESSED CONCRETE
Design of prestressed and post-tensioned concrete sections in flexure and shear. Prestressing systems and ultimate strength methods will be introduced. Prereq: CiE 793 or permission. 3 cr.

793. STRUCTURAL DESIGN IN STEEL
The design of members and connections: tension and compression members, beams, plate girders; riveted, bolted, and welded joints. Introduction to plastic design of beams and frames. Prereq: CiE 682 or permission. 4 cr.

794. REINFORCED CONCRETE DESIGN
The design of reinforced concrete members by Strength Design Theory including beams, columns, beam-columns, and slabs for strength and deformations. Prereq: CiE 682. 4 cr.

795-796. INDEPENDENT STUDY
A limited number of qualified senior and graduate students will be permitted to pursue independent studies under faculty guidance. Seniors may write terminal theses reporting the results of their investigations. 1-4 cr.

Classics

(See Ancient and Modern Languages and Literatures)

Communication

(See Theater and Communication)

Communication Disorders (Comm)

(For program description, see page 67)

CHAIRPERSON: F. Harry Tokay
ASSOCIATE PROFESSORS: Frederick C. Lewis, Frederick P. Murray, F. Harry Tokay
ASSISTANT PROFESSOR: Mary Ann Records
CLINICAL SUPERVISOR: Yvonne Newport-Korwatch
ADJUNCT FACULTY: Bernard P. Henri, Mary A. Rahn, Claire Sheridan

Comm 520 is a prerequisite for all courses in the department.

520. SURVEY OF COMMUNICATION DISORDERS
Causes, diagnosis, and treatment of speech, language, and hearing disorders. 4 cr.

521. ANATOMY AND PHYSIOLOGY OF THE SPEECH AND HEARING MECHANISMS
Anatomy, physiology, neurology, and function of the mechanisms for the production and perception of speech. 4 cr.

524. APPLIED PHONETICS OF AMERICAN ENGLISH
International Phonetic Alphabet; its practical application to speech therapy and/or the student's professional interest. 4 cr.

530. TECHNICAL SKILLS IN SPEECH PATHOLOGY
Introduces basic skills essential to the study of communication disorders: critical reading, professional writing, objective observation, treatment program development. History of the profession, requirements and governance of the profession. 2 cr.

631. SPEECH PATHOLOGY I
Normal development of speech and language. Research, diagnosis, and therapy procedures as applied to communication disorders, articulation, and language. 4 cr.

632. SPEECH PATHOLOGY II
Diagnosis, therapy, and counseling procedures applied to communication disorders; emphasis on cleft palate, cerebral palsy, and aphasia. Prereq: Comm 631 or permission. 4 cr.

633. AMERICAN SIGN LANGUAGE I
Introduction to the vocabulary, finger spelling, and grammatical processes of American Sign Language. Emphasis on applying basic principles of sign language, psychosocial aspects of deafness, and the deaf person as bilingual. Prereq: permission. 2 cr.

634. CLINICAL PRACTICE IN SPEECH PATHOLOGY
Supervised experiences in diagnosis and therapy with speech-handicapped children and adults. Experiences with school-age children in individual and group therapy. Prereq: Comm 524 and 632. 4 cr. Cr/F.

638. THE ACQUISITION OF LANGUAGE
Review of research and theories in speech pathology, education, linguistics, and learning theory related to development of language in the normal child. 4 cr.

650. PRINCIPLES AND PRACTICE OF PUBLIC SCHOOL SPEECH THERAPY
Principles, goals, and philosophy of public school speech and language therapy. Supervised practicum. Prereq: Comm 634. Lab. 4 cr.

660. SPECIAL PROBLEMS IN COMMUNICATION DISORDERS
Individual or group projects to enrich or expand theoretical knowledge and to afford an opportunity for applied experience. Prereq: permission and arrangement with faculty. May be repeated to a maximum of 8 credits. 2, 4, 6, or 8 cr.

701. AMERICAN SIGN LANGUAGE II
Advanced phonology, syntax, and semantics of American Sign Language. Emphasis on grammatical processes that modulate meaning of signs in discourse and development of receptive language skills. Prereq: Comm 633 and permission. 2 cr.

702. AMERICAN SIGN LANGUAGE III
Emphasis on the advanced linguistic principles of American Sign Language including idioms, slang, and their place in the communication patterns of the deaf. Improvement of speed and accuracy in receptive and expressive skills for communicating with the deaf. Educational and vocational problems associated with deafness. Prereq: Comm 701 and permission. 2 cr.

704. BASIC AUDIOLOGY
Normal hearing process and pathologies of the auditory system. Hearing screening, pure-tone testing, and speech audiometry. Prereq: Comm 521 or permission. 4 cr.

705. INTRODUCTION TO AUDITORY PERCEPTION AND AURAL REHABILITATION
Research, testing, and clinical procedures of auditory perception, applied to the communicatively impaired. Prereq: Comm 704; permission. 4 cr.

706. STUTTERING
Theoretical and therapeutic considerations of the stuttering syndrome; emphasis upon clinical management. Prereq: Comm 632 or permission. 4 cr.

780. SEMINAR IN DIAGNOSIS OF SPEECH AND LANGUAGE DISORDERS
Principles and practice for diagnosis of speech and language disorders; examination procedures and measurement techniques. Prereq: Comm 632. 4 cr.

795. INDEPENDENT STUDY
Application of the theory to specific communication disorder areas for individual or group projects. Prereq: permission. May be repeated to a maximum of 8 credits. 2, 4, 6, or 8 cr.

Community Development

(See Institute of Natural and Environmental Resources)

Computer Engineering

(See Electrical and Computer Engineering)

Computer Science (C S)

(For program description, see page 56)

CHAIRPERSON: R. Daniel Bergeron
PROFESSOR: Shan S. Kuo
ASSOCIATE PROFESSORS: R. Daniel Bergeron, Eugene C. Freuder, Robert D. Russell
ASSISTANT PROFESSORS: Helen M. Gigley, Dov Harel, James L. Weiner
FACULTY IN RESIDENCE: Brian L. Johnson
ADJUNCT ASSISTANT PROFESSOR: Sylvia Weber Russell

403. INTRODUCTION TO DIGITAL COMPUTER PROGRAMMING
Development of algorithms and programs. Basic programming and programming structure utilizing FORTRAN IV language; use of an operating system, computer solution of numerical and nonnumerical problems. Intended for chemical engineering majors. No credit toward a math or C S major. Credit cannot be received for both C S 403 and C S 410F. 2 cr.

410. INTRODUCTION TO COMPUTER PROGRAMMING
A set of three 2-credit modules. Introductory module, first half of the semester. Modules C and F, second half of the semester. Introductory module prerequisite for C and F. Permission required to register for less than 4 cr. Note: The deadline for dropping this course without academic liability is the fourth Friday after the course begins. 2-6 cr.

410. Introductory Programming
Introduction to the concepts and techniques of computer programming. Particular emphasis is placed on good programming style. The programming language PASCAL is used.

410C. Business Programming with COBOL
Introduction to basic algorithms and techniques used in business programming. The COBOL programming language is taught and used for the programming assignments.

410F. Scientific Programming with FORTRAN
Introduction to basic algorithms and techniques used in scientific programming. The FORTRAN programming language is taught and used for the programming assignments.

503. APPLIED COMPUTER TECHNIQUES
Applications of the computer in science and engineering problem solving. Advanced data structures and programming techniques using FORTRAN. Use of existing packages for numerical techniques, plotting, and simulation. Credit cannot be received for both C S 503 and C S 612. Prereq: C S 410 and C S 410F. 4 cr.

610. OPERATING SYSTEM FUNDAMENTALS
Introduction to operating system concepts and design. Job, process, and resource management; I/O programming. Hands-on use of laboratory mini or microcomputer. Prereq: C S 611 or C S 612 or E E 612. 4 cr.

611. ASSEMBLER-LANGUAGE PROGRAMMING
Assembler-language coding and programming techniques. Data representation, systems organization, program segmentation, linkage of control section, manipulation of bits or bytes, and macroprogramming. Input/output using System macros. Interrupts. Prereq: C S 410; 410F. 4 cr.

612. DATA STRUCTURES AND PROCESSES
Data structure programming techniques and program structure using a higher-level language. Linear lists, strings, arrays, trees, and graphs. Symbol tables, sorting and searching techniques. Data organization, record-oriented and stream-oriented data transmission, conversion techniques, and storage allocation. Prereq: C S 410. 4 cr.

696. INDEPENDENT STUDY
Projects of interest and value to student and department. Prereq: permission of faculty supervisor and department chairperson. 1-6 cr.

710. ADVANCED SYSTEMS PROGRAMMING
Topics in systems programming, including organization and implementation of assemblers, linkage editors, job schedulers, command language decoders. File systems, protection, security, performance evaluation, and measurement. Prereq: C S 610 and C S 611. 4 cr.

711. PROGRAMMING LANGUAGES AND COMPILERS
Formal definition of programming languages; specification of syntax and semantics. Properties of algorithmic languages such as PL/I and ALGOL. Review of special purpose languages for list processing, symbol manipulation, data description and simulation; run-time representation of program and data structures; how these properties affect compilation. Prereq: all modules of C S 410 and C S 612. 4 cr.

712. COMPILER DESIGN
Formal languages and formal techniques for syntax analysis and parsing; organization of the compiler and its data structures; problems presented by error recovery and code generation. Classical top-down and bottom-up techniques currently in widespread use, general discussion of LL(k) and LR(k) parsers; automatic methods of compiler generation and compiler compilers. Students required to define a simple, nontrivial programming language and to design and implement its compiler. Prereq: C S 711. 4 cr. (Not offered every year.)

713. COMPUTER GRAPHICS
Input-output and representation of pictures from hardware and software points of view; interactive techniques and their applications; three-dimensional image synthesis techniques. Prereq: C S 612; C S 610; /or permission. 4 cr. (Not offered every year.)

714. INTRODUCTION TO PROGRAMMING SEMANTICS
Informal, nonmathematical introduction to descriptive techniques of denotational semantics. Provides framework needed to describe formally programming languages such as PASCAL. No previous knowledge of the theory of computation or of any particular programming language is assumed. Prereq: C S 711; /or permission. 4 cr. (Not offered every year.)

715. INTRODUCTION TO ARTIFICIAL INTELLIGENCE
Machine intelligence, representation and control issues, search methods, problem solving, learning computer vision, natural language understanding, knowledge engineering, game playing. Heuristic programming and the LISP language. Prereq: CS 711. 4 cr. (Not offered every year.)

716. DATABASE TECHNIQUES
Database analysis and design. Hierarchic, network, and relational models. Data normalization, data manipulation tools, data description languages, query functions and facilities, design and translation strategies, file and index organizations, data integrity and reliability, data security techniques, distributed database systems, actual usage of selected DBMS on computers. Prereq: C S 612. 4 cr. (Not offered every year.)

753. NUMERICAL METHODS AND COMPUTERS I
Use of scientific subroutine and plotter routine packages, floating point arithmetic, polynomial and cubic spline interpolation, implementation problems for linear and nonlinear equations, random numbers and Monte Carlo method, Romberg's method, optimization techniques, finite elements. Selected algorithms programmed for computer solution. Prereq: Math 426; C S 410 and C S 410F. (Also offered as Math 753.) 4 cr.

754. NUMERICAL METHODS AND COMPUTERS II
Mathematical software. Computer solutions of differential equations, finite differences vs. finite elements, eigenvalues and eigenvectors. Prereq: Math 527; C S 410 and C S 410F. (Also offered as Math 754.) 4 cr.

758. ANALYSIS OF ALGORITHMS
Introduction to use of basic mathematics in design and analysis of computer algorithms. Topics include O-notation, divide and conquer, the greedy method, dynamic programming, and NP-completeness. Prereq: Math 531C and C S 612. 4 cr. (Not offered every year.)

790. TOPICS IN COMPUTER SCIENCE
Offered on an irregular basis with varying content. 1-4 cr.

Dance

(See Theater and Communications)

Division of Continuing Education (DCE) Career Concentration Courses

(For program description, see page 87)

DIRECTOR OF DIVISION OF CONTINUING EDUCATION: Edward J. Durnall

506. FIELD EXPERIENCE
Supervised work experience with planned learning objectives relating to either the student's major or career concentration. Prereq: permission. May be repeated to a maximum of 8 credits for Associate in Arts degree students. 2-8 cr.

599. SPECIAL TOPICS
Occasional course offerings of specialized material in A.A. career concentrations; general studies topics for nontraditional learners; travel/study programs. Prereq: permission. 1-4 cr.

606. FIELD EXPERIENCE
Supervised work experience with planned learning objectives related to the student's major or area of concentration. May be repeated to a maximum of 4 credits for baccalaureate degree students. Prereq: permission. 1-4 cr. Cr/F.

607. FIELD EXPERIENCE IN ENGINEERING AND PHYSICAL SCIENCES
Supervised work experience with planned learning objectives related to the student's major or area of concentration. May be repeated for credits, which are in addition to degree requirements. 1 cr. Cr/F.

608. PROFESSIONAL PRACTICE
Based on an appropriate concurrent work experience, student readings, and reports to articulate the learning that takes place in the transition from college to professional employment. Deals with the appropriate attitudes, habits, and skills for success. May be repeated to 4 cr. Prereq: permission. 1-2 cr. Cr/F.

Accounting

These accounting courses are not open to UNH bachelor's degree candidates.

462-463. PRINCIPLES OF FINANCIAL ACCOUNTING
Two-semester sequence covering the principles of financial accounting. Double-entry, accrual accounting model and its application to service and merchandising firms. Accounting cycle, from the design of the system and the analysis of transactions to the final preparation of financial statements. 4 cr.

561. PRINCIPLES OF COST ACCOUNTING
Accounting for the flow of manufacturing costs in an industrial firm. Accounting for raw materials, direct labor and factory overhead, flow of costs in acquisition, work-in-progress, and finished goods to costs of goods sold. Job order and process cost systems, and concepts of standard and variance analysis. Prereq: DCE 462. 4 cr.

562. TAX PRINCIPLES AND PROCEDURES
Principles of federal, state, and local taxes; emphasis on federal income tax. Principles of taxation, tax planning, tax accounting, and the preparation of basic individual and business returns. New Hampshire and local taxes. Prereq: DCE 462. 4 cr.

563. PRINCIPLES OF MANAGERIAL ACCOUNTING
Need for and analysis of accounting data in the managerial planning and control process. Use of accounting information in the management of ongoing operations, in special nonrecurring decisions, and in long-range planning and capital budgeting. Prereq: DCE 462-463; DCE 561. 4 cr.

Computer Information Studies

These computer information studies courses are not open to UNH bachelor's degree candidates.

490. INTRODUCTION TO COMPUTER INFORMATION STUDIES
Information systems concepts and applications: text editing, word processing, structured programming, and data based management. Emphasis placed on laboratory experience to develop strong skills in interactive communications with computers. Students will learn to use the computer with high-level programming languages (e.g., PASCAL). Prereq: C S 410. 4 cr.

590. INFORMATION SYSTEMS APPLICATIONS
Emphasizes hands-on experience in using microcomputers for integrated word and data processing, and data based management. Applications include: office management, accounting, and financial management. Students will use and adapt prepackaged software. Prereq: C S 410; DCE 490. 4 cr.

591. INTERACTIVE SYSTEMS DESIGN
Design and implementation of integrated systems such as inventory or accounting. Topics include: human factors, file creation and maintenance using CRT on-line communications facilities, sorting, and report writing on both large and microcomputer systems. Prereq: C S 410; C S 410C; DCE 490. 4 cr.

592. DATA BASE APPLICATIONS
Students will design and implement a management information system using a data base management system, statistical and simulation programs. Prereq: C S 410; C S 410C; DCE 490; statistics or quantitative analysis. 4 cr.

Criminal Justice

550. CRIMINAL JUSTICE ADMINISTRATION AND ORGANIZATION
Contemporary methods of administrative practice for efficient use of personnel, facilities, and equipment; planning and research; budgeting and control; decision making; communications. 4 cr. (Not offered every year.)

551. CRIME PREVENTION AND CONTROL
Coordinating the efforts of the community and criminal justice agencies. Problem solving in specific crime analysis—the offense, the offender, and community environment. 4 cr. (Not offered every year.)

552. CORRECTIONS TREATMENT AND CUSTODY
Scientific diagnosis and treatment of offenders. Institutional administration methods—climate, personnel, structure, and procedure. 4 cr. (Not offered every year.)

554. JUVENILE JUSTICE ADMINISTRATION AND ORGANIZATION
Techniques and methods of organizing and administering police juvenile units: role, function, and responsibilities of juvenile officers within the juvenile justice system. Prereq: permission. 4 cr. (Not offered every year.)

555. DELINQUENCY PREVENTION AND CONTROL
Causes of delinquency; pathogenic patterns; and diagnosis of child abuse. Prevention and treatment of child abuse and delinquency through coordination of the efforts of community and criminal justice agencies. Prereq: permission. 2 cr. (Not offered every year.)

Library and Information Services

401. INTRODUCTION TO LIBRARY PUBLIC SUPPORT SERVICES
History; philosophy of library service; philosophy of reference service; reference and bibliographic tools. 4 cr. (Not offered every year.)

402. ACQUISITION, CLASSIFICATION, AND CIRCULATION SYSTEMS
Acquisition and processing of materials; classification systems; technical aspects of circulation systems. 4 cr. (Not offered every year.)

501. INFORMATION SERVICES MANAGEMENT
Information services management; controlling information flow; evaluating information needs of organizations; technological planning of the transfer of information. 4 cr. (Not offered every year.)

503. CHILDREN'S LIBRARY SERVICES
Materials for children; working with children; implementing special programs; selection of materials; reference methods; audio-visual materials. 4 cr. (Not offered every year.)

Management

These management courses are not open to UNH bachelor's degree candidates.

430. MANAGEMENT PRINCIPLES AND ORGANIZATION
Management philosophy and practices; organization, structure, communication, planning, controlling, and decision making. 4 cr.

431. HUMAN BEHAVIOR AND SUPERVISION
Nature of people at work; leadership; informal organization; employee training and development; motivation, morale, and performance appraisal; and counseling for improvements. Can be offered as one-credit modules in: Human Relations and Motivation, Effective Supervision, Employee Training and Development, and Employee Relations. Career concentration students required to complete 431 must take 4 credits. 1-4 cr.

432. PRINCIPLES OF ACCOUNTING
Sole proprietorship, partnership, and the corporation; recording, summarizing, and reporting data; systems to account for and control purchases, sales, cash, receivables, and inventory; valuation of assets and measurements of income. Not open to students who have had DCE 462 or the A.A. degree candidates in accounting career concentration. 4 cr.

530. ECONOMICS
U.S. economy and its component units. Macro- and microeconomic perspectives. Not open to students who have had Econ 401 or 402, or REco 411. 4 cr.

531. SALESMANSHIP
Principles and techniques of personal selling; customers needs and satisfaction. 4 cr.

532. BUSINESS LAW
Legal theory, practice, and precedents in everyday business situations. Not open to students who have had Admn 647. 4 cr.

533. CREDIT MANAGEMENT
Credit—its effect on the money supply and its role in the economy; commercial and consumer borrowing; credit policy, analysis, and regulations; secured and unsecured credit; collections; receivables; management of credit; and decision making. 4 cr. (Not offered every year.)

534. SMALL BUSINESS MANAGEMENT ISSUES
The environment of small business. Financial planning and procedures for starting a small business; developing and establishing a marketing plan; operating a going business; franchising; and cash flow management. 4 cr. (Not offered every year.)

535. OFFICE PROCEDURES AND MANAGEMENT
Methods and procedures of traditional and modern administrative office operations; office systems, word processing, records management, staffing, and organization of work flow. 4 cr.

Merchandising

These merchandising courses are not open to UNH bachelor's degree candidates.

410. FUNDAMENTALS OF MERCHANDISING
Practices and procedures in marketing goods and services; retailing and wholesaling; channels of trade; functions of middlemen. 4 cr. (Not offered every year.)

411. PROMOTION AND ADVERTISING
Mass communication in marketing; use of advertising media; integration of promotional plans and sales techniques; evaluation of promotional efforts. 4 cr. (Not offered every year.)

510. RETAILING
Managing a goods or services retail enterprise; store location and organization, layout, buying and pricing, advertising and sales promotion, inventory control, and personnel policies. 4 cr. (Not offered every year.)

512. FASHION MERCHANDISING AND DISPLAY
Principles and procedures used in selection, promotion, and selling of fashion apparel and accessories. Analysis of principles of display. Prereq: DCE 410 or permission. 4 cr. (Not offered every year.)

Real Estate

These real estate courses are not open to UNH bachelor's degree candidates.

425. FUNDAMENTALS OF REAL ESTATE
History and development of property ownership; title and legal processes; limitations and restrictions of rights, contracts, and agreements; deeds and transfer of property. 4 cr.

426. REAL ESTATE APPRAISAL
Principles of land and building analysis, cost estimation, depreciation, and influences affecting value of residential and commercial property. Prereq: DCE 425. 4 cr. (Not offered every year.)

525. REAL ESTATE LAW
Fundamentals of real estate law; nature and classes of property; ownership; purchase and sales; and rights, duties, and responsibilities of the broker. 4 cr. (Not offered every year.)

526. REAL ESTATE FINANCE
Mortgages, loans, and financing residential and commercial property. 4 cr. (Not offered every year.)

Career Electives

These career elective courses are not open to UNH bachelor's degree candidates who entered September, 1982, or later. This rule does not apply to those who were admitted under earlier catalogs. (Not offered every year.)

420. PRINCIPLES OF INSURANCE
History, ethics, and the theory of risk. Major types of insurance. Operation and administration of an agency. 4 cr.

421. LIFE AND HEALTH INSURANCE
Insurance programs for the individual. History; types of contracts; legal concepts; and government, group, and individual programs. 4 cr.

422. PROPERTY, LIABILITY, AND MARINE INSURANCE
Fire, casualty, transportation, marine, and aircraft insurance; fidelity and surety bonds; worker's compensation; underwriting, loss adjustment, and prevention; government regulations, rate making and reinsurance. 4 cr.

440. MONEY AND BANKING
American financial system. How money is created and affects economy. Monetary policy. Pre- or coreq: DCE 530 or Econ 401. Not open to students who have had Econ 635. 4 cr.

441. BANK OPERATIONS
Cash management and control, clearing and collections operations, loan and deposit administration, internal audit, and ancillary services. Pre- or coreq: DCE 432 or 462. 4 cr.

470. INTRODUCTION TO TRANSPORTATION AND TRAFFIC MANAGEMENT
Characteristics and operations of the various modes and classes—common, contract, exempt, and private. Relationship between distribution management and other operational activites. 4 cr.

471. CARRIER OPERATIONS
Principles of freight traffic; shipper-carrier relations. Terminal operations, freight handling, dispatching, inventory controls, employee relations, and other areas related to the operation of the transportation industry. 4 cr.

480. FUNDAMENTALS OF QUALITY CONTROL
Planning, organizing, and administering quality control operations in relation to company policy and objectives. 4 cr.

540. BANK INVESTMENTS
Investment and portfolio analysis in relation to bank operations; constraints affecting liquidity, safety, and profitability; types of securities; optional timing of investment transactions. Prereq: DCE 440. 4 cr.

570. PRINCIPLES OF PHYSICAL DISTRIBUTION
Elements involved in physical distribution and their interrelationships: inventory management, warehousing, industrial packaging, materials handling, physical flow, labor relations, cost control, forecasting. 4 cr.

571. TRANSPORTATION REGULATIONS
Relationships among federal, state, and international regulatory agencies and the modes and classes of transportation. Interstate Commerce Act application and interpretation; handling and filing of claims; documentation; export-import regulations; safety requirements; and labor contracts. Prereq: DCE 470 or permission. 4 cr.

580. QUALITY CONTROL ENGINEERING
Pre-process, in-process, and post-process control techniques. Data accumulation classification, evaluation, measurement, reporting, and costs. Prereq: DCE 480 or permission. 4 cr.

581. STATISTICAL APPLICATIONS TO QUALITY CONTROL
Tendency and variation, normal curve applications, histogram analysis, control charts, sampling plans, and Dodge-Romig and Military Standard Tables. Prereq: DCE 480 or permission. 4 cr.

582. PROCUREMENT QUALITY CONTROL
Optimizing the quality of incoming materials and supplies. Quality specifications, receipt, source inspection, and vendor surveys and ratings. Prereq: DCE 480 or permission. 4 cr.

Earth Sciences (ESci)

(For program description, see page 57)

CHAIRPERSON: Herbert Tischler
PROFESSORS: Franz E. Anderson, Wallace A. Bothner, Henri E. Gaudette, Cecil J. Schneer, Herbert Tischler
ASSOCIATE PROFESSORS: Francis S. Birch, Wendell S. Brown, Theodore C. Loder III, Paul A. Mayewski
ASSISTANT PROFESSORS: Jo Laird, William Berry Lyons
RESEARCH ASSOCIATE PROFESSOR: James D. Irish
ADJUNCT PROFESSOR: Robert I. Davis

401. PRINCIPLES OF GEOLOGY I
The earth; earth materials (rocks and minerals), landforms, and the processes that form them (volcanism, earthquakes, glaciation, etc.). Field trips. Lab. 4 cr.

402. PRINCIPLES OF GEOLOGY II
The geological history of the earth: an interpretation of past geologic events emphasizing the geological development of North America and the evolution of life. Prereq: ESci 401. Lab. 4 cr.

409. ENVIRONMENTAL GEOLOGY
Environmental impact of geologic processes; natural hazards—landslides, earthquakes, volcanoes, flooding, erosion, and sedimentation; land exploitation and site investigations; environmental considerations of water-supply problems; the recovery of energy and mineral resources. Lab. Students may not receive credit for both ESci 401 and ESci 409. 4 cr.

501. INTRODUCTION TO OCEANOGRAPHY
Physical, chemical, geological, and biological processes in the sea. 4 cr.

502. INTRODUCTION TO OCEANOGRAPHY LABORATORY
Laboratory complements and expands upon ESci 501 lectures; registration for ESci 502 is optional. Navigation, tides, currents, waves, chemical and physical aspects of seawater, pollution, etc. Co- or prereq: ESci 501. 1 cr.

512. PRINCIPLES OF MINERALOGY I
Natural history of the solid state; introductory crystallography, diffraction, and structure of minerals. Non-silicate minerals; their chemical and physical properties, origins, occurrences, and uses. Prereq: ESci 401 or 409; Chem 401 or 403, or 405. Field trips. Lab. 4 cr.

513. PRINCIPLES OF MINERALOGY II
Silicate minerals; their chemical and physical properties, structures, origins, occurrences, and uses. Optical mineralogy. Prereq: ESci 512. Field trips. Lab. 4 cr.

531. STRUCTURAL GEOLOGY
Structural units of the earth's crust and mechanics of their formation. Prereq: ESci 402. Lab and fieldwork. 4 cr.

561. GEOMORPHOLOGY
Processes leading to the development of landforms. Field trips. Prereq: ESci 401. Lab. 4 cr.

595. SPECIAL PROJECT IN THE EARTH SCIENCES
A) Oceanography, 1-4 cr.

614. PETROGRAPHY
Description and classification of igneous, sedimentary, and metamorphic rocks in hand specimen and thin section; optical mineralogy. Prereq: ESci 513. Lab. 4 cr.

652. BIOSTRATIGRAPHY
Stratigraphic principles and the study of invertebrate fossils emphasizing their stratigraphic and paleoecologic uses. Prereq: ESci 402; /or permission. Lab. 4 cr.

725. IGNEOUS AND METAMORPHIC PETROLOGY
The origin, formation, and geologic history of igneous and metamorphic rocks as determined from field and laboratory studies of occurrences, mineral assemblages, rock composition, and texture. Interpretation of rock and mineral compositional diagrams; application of experimental investigations. Prereq: ESci 614. Field trips. Lab. 4 cr.

732. GEOLOGIC MAPPING AND INTERPRETATION
Standard methods of geologic field mapping; interpretation of geologic maps and aerial photographs of selected areas. Course includes field mapping excursions to local areas and an 8-10 day exercise in a selected area of the Appalachian Mountains. A lab fee includes transportation and housing in the field. Prereq: ESci 531 or permission. Lab. 4 cr.

734. APPLIED GEOPHYSICS
Gravity, magnetic, seismic, electrical, and thermal methods of investigating subsurface geology. Fieldwork and use of computers in data analysis. Prereq: ESci 401; one year of calculus; one year of college physics; /or permission. Lab. 4 cr.

741. GEOCHEMISTRY
Thermodynamics applied to geological processes; geochemical differentiation of the earth; the principles and processes that control the distribution and migration of elements in geological environments; stable and radiogenic isotopes in geologic processes. 4 cr.

752. CHEMICAL OCEANOGRAPHY
Water structure, chemical composition and equilibrium models, gas exchange, biological effects on chemistry, trace metals, and analytical methods. Laboratory includes short cruise aboard R/V *Jere A. Chase*. Prereq: permission. Lab (optional). 3 or 4 cr.

754. MODERN SEDIMENTS
Examines modern sediments from a process-oriented viewpoint. Emphasis will be placed on shallow water modern marine sediments including shelf, beach, and estuarine deposits. Animal/sediment interactions will be considered. Laboratory investigates applied techniques in modern sediment analysis. Prereq: ESci 401 or 501 or permission. Lab. 4 cr.

758. INTRODUCTION TO PHYSICAL OCEANOGRAPHY
Ocean basins; physical properties of seawater; atmosphere-ocean interaction; general ocean circulation; waves and tides; continental shelf and nearshore processes; instrumentation and methods used in ocean research. Simplified physical and mathematical models demonstrate the important concepts. Prereq: one year of calculus and college physics; introductory oceanography; /or permission. Variable credit: 3 cr. without lab, 4 cr. with optional lab and field project.

759. GEOLOGICAL OCEANOGRAPHY
Major geological features and processes of the ocean floor; geological and geophysical methods; plate tectonics. Prereq: permission. 4 cr.

762. GLACIAL GEOLOGY
The glacial environment: glacier dynamics and glacial erosion and deposition. Review of world glacial stratigraphy in light of causes of glaciation and climatic change. Field trips. Prereq: ESci 561; /or permission. Lab. 4 cr.

771. MINERAL DEPOSITS
An introduction to the processes of formation, geological characteristics, and environments of deposition of metallic mineral deposits, and a brief survey of the unique nature and importance of the mineral industries. Prereq: ESci 531; 614. 4 cr.

795. TOPICS IN EARTH SCIENCES
A) Areal Geology; B) Geochemistry; C) Geomorphology, Advanced; D) Geophysics; E) Glacial Geology, Advanced; F) Groundwater Geology; G) Historical Geology, Advanced; H) Industrial Minerals: I) Micropaleontology; J) Mineral Fuels; K) Mineralogy, Advanced; L) Optical Crystallography; M) Ore Deposits; N) Paleontology, Advanced; O) Petrology, Advanced; P) Regional Geology; Q) Sedimentation; R) Stratigraphy; S) Structural Geology, Advanced; T) Marine Geology; U) Physical Oceanography; V) History of Geology; W) Earth Science Teaching Methods; X) Senior Synthesis; Y) Chemical Oceanography; Z) Glaciology, Advanced. Special problems by means of conferences, assigned readings, and field or laboratory work, fitted to individual needs from one of the areas listed above. 1-4 cr.

Economics (Econ)

(For program description, see page 77)

PROFESSORS: Robert F. Barlow, Manley B. Irwin, John J. Korbel, Sam Rosen, Kenneth J. Rothwell, Dwayne E. Wrightsman
ASSOCIATE PROFESSORS: Allan J. Braff, Richard W. England, Marc W. Herold, Richard W. Hurd, Richard I. Mills, Robert C. Puth, Allen R. Thompson
ASSISTANT PROFESSORS: Michael A. Conte, Marilyn Power, Robert E. Rosenman, Evangelos O. Simos

400. ECONOMIC ISSUES
Economic analysis applied to current issues such as environmental pollution, federal deficit spending, monopoly and waste, poverty, racism, the energy shortage, the urban crisis, war and the economy, etc., discussed in a nontechnical, conceptual framework. Reports and discussion on outside readings. No credit toward a major or minor in economics; cannot be taken concurrently with Econ 401 or 402 or after completion of Econ 401 or 402. 4 cr.

401. PRINCIPLES OF ECONOMICS (MACRO)
Basic functions of the United States economy viewed as a whole: policies designed to affect its performance. Economic scarcity, supply and demand, the causes of unemployment and inflation, the nature of money and monetary policy, the impact of government taxation and spending, the federal debt, and international money matters. 4 cr.

402. PRINCIPLES OF ECONOMICS (MICRO)
Functions of the component units of the economy and their interrelations. Units of analysis are the individual consumer, the firm, and the industry. Theory of consumer demand and elasticity, supply and costs of production, theory of the firm under conditions of perfect and imperfect competition, demand for and allocation of economic resources, general equilibrium, and basic principles and institutions of international trade. (Not open to students who have had REco 411.) 4 cr.

515. ECONOMIC HISTORY OF THE UNITED STATES
United States economy from colonial times to the present. Models of economic development applied to the United States. How social, political, technological, and cultural factors shape economy; development and influence of economic institutions. Prereq: Econ 401 or 402 or permission. 4 cr.

518. EUROPEAN ECONOMIC HISTORY
Western European economies from medieval times to the present. Explanations for differential growth rates and patterns; contrasts between political, social, and economic events. Prereq: Econ 401 or 402; /or permission. 4 cr.

525. INTRODUCTION TO ECONOMIC STATISTICS
Principal statistical concepts and techniques used in empirical economics: descriptive statistics, probability theory, random variables and their distributions, expected values, sampling inferential statistics, correlation and regression analysis, analysis of variance, time series analysis, index numbers. Also, principal sources of economic data. 4 cr.

601. INCOME DISTRIBUTION: WEALTH AND POVERTY
Examination and discussion of problems/issues of historical and current interest. Topics include comparative review of distribution systems, redistribution, poverty, the impact of inflation and taxation, normative and positive dimensions of the distribution of income and wealth. 4 cr.

605. INTERMEDIATE MICROECONOMIC ANALYSIS
Analysis of supply and demand. Determination of prices, production, and the distribution of income in noncompetitive situations and in the purely competitive model. General equilibrium. Prereq: Econ 402. 4 cr.

611. INTERMEDIATE MACROECONOMIC ANALYSIS
Macroeconomic measurement, theory, and public-policy determination. Prereq: Econ 401 and 402. 4 cr.

615. HISTORY OF ECONOMIC THOUGHT
Examination and critical appraisal of the work of major economists, including the work of contemporary economists, and major schools of economists, particularly with reference to the applicability of their theories to current economic problems. Prereq: Econ 401 and 402. 4 cr.

626. INTRODUCTION TO QUANTITATIVE ECONOMICS
Development of the concept of a simple, testable economic model of explanatory or forecasting type. Alignment of the model with reality by means of computer-performed statistical estimation. Types of error, consequences, and possible methods of dealing with errors. Prereq: Econ 525. 4 cr.

630. COMPARATIVE STUDY OF ECONOMIC SYSTEMS
Theoretical models of capitalism and socialism. Their historical implementation as exemplified by the United States, France, Yugoslavia, U.S.S.R., China, and Cuba. Prereq: Econ 401 and 402. 4 cr.

635. MONEY AND BANKING
Financial markets, financial institutions, monetary theory, monetary policy, causes and cures of inflation and related problems. Prereq: Econ 401 and 402. 4 cr.

641. PUBLIC FINANCE
Alternative prescriptions and explanations concerning the role of government in contemporary market economies. General principles of public expenditure analysis. Selected case studies of public spending programs; e.g., welfare, defense, education. Analysis of various federal, state, and local taxes. Prereq: Econ 401 and 402, or permission. 4 cr.

645. INTERNATIONAL ECONOMICS
Trade theory and commercial policy. Free trade, protection, common markets. Economic aspects of international relations, with particular reference to recent policy issues. Prereq: Econ 401 and 402. 4 cr.

651. GOVERNMENT REGULATION OF BUSINESS
Mergers, competition, monopoly, and the regulated industries. 4 cr.

655. LABOR UNIONS AND THE WORKING CLASS
Workers' role in the economy and the unions they form to protect their interests. History of the American labor movement; evaluation of the success of unions in fulfilling workers' needs. Management's relationship with workers in the context of a power struggle between unions and managers. Government's role in collective bargaining as intermediary and as employer. 4 cr.

656. LABOR ECONOMICS
Functioning of labor markets from theoretical and policy perspectives. Labor supply, wage determination, internal labor markets, and barriers to upward labor market mobility. Poverty, unemployment, inflation, and wage-price controls. Prereq: Econ 401 and 402; /or permission. 4 cr.

658. WOMEN AND WORK
Women's experience as workers. Significance for the economy of their work in the labor force and

their unpaid labor in the home. Emphasis on the U.S., with some attention to socialist and less developed countries. Readings contrast different theoretical approaches. Prereq: Econ 401; Econ 402; /or permission. 4 cr.

668. ECONOMIC DEVELOPMENT
Analysis of problems and available solutions confronting the underdeveloped areas of the world. Prereq: Econ 401 and 402. 4 cr.

695-696. INDEPENDENT STUDY
Individual research projects that are student designed. Initial sponsorship of an Economics faculty member must be obtained, and approval of WSBE adviser and dean. For upperclassmen in high standing. Variable (in multiples of 2) 2-12 cr.

698. TOPICS IN ECONOMICS
Special topics. May be repeated. Prereq: permission. 4 cr.

711. ECONOMIC FLUCTUATIONS
Recurrent movements of prosperity and depression; emphasis on causes and public-policy implications. Prereq: Econ 611 or permission. 4 cr.

715. MARXIAN ECONOMIC ANALYSIS
Marx's analysis of capitalism within the classical and radical tradition; methodology; organization of capital; labor theory of value; accumulation of capital; growth and distribution; economic crises. Critical evaluation of Marx's analysis. Prereq: Econ 605 and 611; /or permission. 4 cr.

720. U.S. ECONOMIC HISTORY
From colonial times to the present. Applied economic theory; economic models and interpretation of data. Influence of technology, industrialization, foreign trade, monetary factors, and government; noneconomic factors. Prereq: Econ 605 and 611; /or permission. 4 cr.

721. EUROPEAN ECONOMIC HISTORY
Western European and Mediterranean economies from medieval times to the Common Market. Economic models and interpretation of data. Capital accumulation, technology, trade, industrialization, monetary factors, and the role of government; relevant noneconomic factors. Prereq: Econ 605 and 611; /or permission. 4 cr.

727. ADVANCED ECONOMETRICS
Provides familiarity with standard proofs and propositions of theoretical econometrics and develops competence in the application of relatively advanced econometric techniques. Use of computer required. Prereq: permission. 4 cr.

735. ECONOMICS OF FINANCIAL MARKETS
Economic analysis of financial market systems. Topics include financial market functions, theories of saving and investment, financial intermediation, flow-of-funds analysis, loanable funds theory, interest rate forecasting, portfolio theory, capital-asset pricing models, structure of interest rates (including term-structure theory), and macroeconomic models of the financial sector. Prereq: Econ 635. 4 cr.

736. SEMINAR IN MONETARY THEORY AND POLICY
Contemporary developments in monetary theory and the evaluation of policy measures. Prereq: Econ 635. 4 cr.

737. DECISION THEORY AND BAYESIAN METHODS
Utility, decision problems, prior and posterior distributions, sufficiency, estimation and hypothesis testing, linear models and sequential sampling. Emphasis on applications to business and economics. Prereq: Math 735. (Also offered as Math 737.) 4 cr. (Not offered every year.)

741. SEMINAR IN PUBLIC FINANCE—THEORY AND POLICY
Selected topics in contemporary theoretical and policy problems of public finance. Prereq: Econ 641. 4 cr.

745. INTERNATIONAL TRADE
Contemporary issues in international economic theory and policy. Analysis of trade theory, dynamics of world trade and exchange, and international commercial policy. Prereq: Econ 645. 4 cr.

746. INTERNATIONAL FINANCE
International monetary mechanism; balance of payments, international investment; exchange rates, adjustment systems, international liquidity, foreign aid, multinational corporations. Prereq: Econ 401 and 402. 4 cr.

747. MULTINATIONAL ENTERPRISES
Internationalization of economies. Growth and implications of multinational corporations at the level of systems. Theories of imperialism, international unity/rivalry; theories of direct investment, exercise of influence and conflict, technology transfer, bargaining with host country; effects on U.S. economy. Prereq: permission. 4 cr.

751. GOVERNMENT REGULATION OF BUSINESS
Analysis of government policy with reference to such problems as conspiracy, monopoly, mergers, unfair practices, and discrimination; legal and economic appraisal of government policy alternatives. Prereq: Econ 651. 4 cr.

752. TECHNOLOGY, INFORMATION, AND PUBLIC POLICY
This course examines the U.S. as a post-industrial economy. The course surveys the impact of microelectronics upon manufacturing, distribution, employment, and competition. Finally, the course explores both domestic and international policy implications of information transfer. 4 cr.

755. COLLECTIVE BARGAINING
Historical development of the U.S. labor movement and the industrial relations system. Contemporary collective bargaining issues; the role of public policy in industrial relations. 4 cr.

756. LABOR ECONOMICS
Recent developments in labor market analysis and public policies related to contemporary labor issues. Labor supply, the structure and stratification of labor markets, economic discrimination, unemployment and poverty, inflation, and wage-price controls. Prereq: Econ 656. 4 cr.

757. ECONOMICS OF WORK
Organization of work under capitalism. Competing management philosophies; response of workers to management practices. Satisfaction of workers with their jobs, trends in worker productivity, alternative work arrangements, and worker participation in management. Prereq: Econ 655 or Econ 656; or permission. 4 cr.

758. LABOR MARKET MODELING
Labor supply and demand forecasting models. Demographic projections of supply. Industrial, occupational projections of demand. Simulation models for analyzing the impact of manpower and welfare programs. Use of the computer involved in doing assigned exercises, but no prior familiarity with computers is required. Prereq: permission. 4 cr.

768. SEMINAR IN ECONOMIC DEVELOPMENT
An advanced reading seminar. Topics include methodologies underlying economic development theory; industrialization and post-import substitution, state capitalist development, stabilization policies, appropriate technologies, the capital goods sector, agricultural modernization schemes, and attempts at transition to socialism. Prereq: permission. 4 cr.

769. CASE STUDIES IN ECONOMIC DEVELOPMENT
A) Southeast Asia; B) Cost-Benefit and Project Analysis; C) Africa; D) Latin America; E) Middle East. Problems and policies in selected countries: evaluations of national plans, programs, and projects; comparative analysis. Prereq: Econ 401 and 402; /or permission. 4 cr.

798. ECONOMIC PROBLEMS
Special topics; may be repeated. Prereq: permission of adviser and instructor. 2 or 4 cr.

Education (Educ)

(For program description, see page 22)

CHAIRPERSON: Roland B. Kimball
PROFESSORS: Angelo V. Boy, Donald H. Graves, Roland B. Kimball, Carleton P. Menge
ASSOCIATE PROFESSORS: Michael D. Andrew, Richard F. Antonak, Charles H. Ashley, Jason E. Boynton, John J. Carney, John G. Chaltas, Ellen P. Corcoran, Ann I. Diller, David D. Draves, Edward J. Durnall, David J. Hebert, Sharon N. Oja, M. Daniel Smith, Deborah E. Stone, Dwight Webb
ASSISTANT PROFESSORS: Grant I. Cioffi, Susan D. Franzosa, Jane A. Hansen, Bruce L. Mallory, Karen A. Mazza, Richard L. Schwab, Sharon R. Vaughn, Mary Bowes Winslow
FACULTY IN RESIDENCE: Judith A. Kull
ADJUNCT PROFESSOR: Donald D. Durrell
ADJUNCT ASSOCIATE PROFESSOR: Richard H. Goodman

410. WOMEN AND EDUCATION
Examination and analysis of women's educational experience. Study of contemporary and historical processes and structure for educating girls and women. Review and discussion of current research in the education of women, issues of discrimination, and equity and alternative strategies for restructuring society's curriculum for the female. 4 cr.

500. EXPLORING TEACHING
For students considering a teaching career. In-school experiences to develop introductory skills in observation and teaching. On-site seminars for analysis and evaluation. Assessment and advisement related to teaching as a career. Prerequisite for further work toward teacher certification. A minimum of seven hours a week, plus travel time, required. Prereq: permission. 4 cr. Cr/F.

611. TEACHING ELEMENTARY SCHOOL SOCIAL STUDIES
Objectives, content, methods, and materials. (Offered in Division of Continuing Education only.) 4 cr.

612. TEACHING ELEMENTARY SCHOOL MATHEMATICS
Objectives, content, methods, and materials. (Offered in Division of Continuing Education only.) 4 cr.

613. TEACHING ELEMENTARY SCHOOL SCIENCE
Involvement with strategies; inquiry and discovery approaches compared with more conventional methods; selection and justification of goals. Survey of resources available for science teachers; analysis of current curriculum projects. (Offered in Division of Continuing Education only.) 4 cr.

691. SCIENCE CURRICULUM AND INSTRUCTION
For inservice and preservice secondary teachers of physics, chemistry, earth science, or general science. Modern curricula and methods; contemporary programs of national interest. Science teaching goals and methods. 4 cr.

694. COURSES IN SUPERVISED TEACHING
Supervised Teaching of Physical Education. 8 cr. Cr/F. Supervised Teaching of Occupational Education. 8 cr. Cr/F. Supervised Teaching of Home Economics. 8 cr. Cr/F. Supervised Teaching of Music. 8 cr. Cr/F. Supervised Teaching of Mathematics. 8 cr. Cr/F.

700. EDUCATIONAL STRUCTURE AND CHANGE
A) Educational Structure and Change; B) Education in America: Backgrounds, Structure, and Function; C) Governance of American Schools; D) School and Cultural Change; E) Teacher and Cultural Change; F) Social Perspectives of Conflict in the Schools; G) Nature and Processes of Change in Education; H) What Is an Elementary School?; I) Schooling for the Early Adolescent; J) Children with Special Needs: Historical and Institutional Aspects; K) Curriculum Structure and Change; L) Stress in Educational Organizations. Organization, structure, and function of American schools; historical, political, and social perspectives; nature and processes of change in education. Two- and 4- credit courses offered each semester (listed in department prior to preregistration; refer to *Time and Room Schedule*). Minimum of 4 credits required for teacher certification. Prereq. for teacher certification students: Educ 500 and permission, which is accomplished by signing the appropriate course roster in the Teacher Education Office. Prereq. for students not seeking teacher certification: permission, as described above. 2 or 4 cr.

701. HUMAN DEVELOPMENT AND LEARNING: EDUCATIONAL PSYCHOLOGY

A) Human Development and Learning: Educational Psychology; B) Human Development: Educational Psychology; C) Human Learning: Educational Psychology; D) Developmental Bases of Learning and Emotional Problems; E) Learning Theory, Modification of Behavior, and Classroom Management; F) Cognitive and Moral Development; G) Evaluating Classroom Learning; H) Deliberate Psychological Education; I) Sex Role, Learning, and School Achievement; J) The Development of Thinking. Child development through adolescence, learning theory, cognitive psychology, research in teaching and teacher effectiveness, and evaluation, all applied to problems of classroom and individual teaching and therapy. Full 4-credit course and 2-credit minicourses offered each semester (listed in department prior to preregistration; refer to *Time and Room Schedule*). Minicourses emphasize either development (first half of semester) or learning (second half). Candidates for teacher certification are required to have at least 2 credits of development and 2 credits of learning, or the full 4-credit course (701A). Prereq. for teacher certification students: Educ 500 and permission, which is accomplished by signing the appropriate course roster in the Teacher Education Office. Prereq. for students not seeking teacher certification: permission, as described above. 2 or 4 cr.

703. ALTERNATIVE TEACHING MODELS

A) Alternative Teaching Models; B) Curriculum Planning for Teachers; C) Alternative Strategies for Maintaining Classroom Control; D) Nature and Goals of Social Studies: K-12; E) Social Studies Instructional Materials: K-12; F) Teaching Elementary and Middle School Science; G) Language Arts for Elementary Teachers; H) Experiential Curriculum; I) Children with Special Needs: Teaching Strategies for the Classroom Teacher; J) Introduction to Computers in Education. Basic teaching models, techniques of implementation, and relationships to curricula. Two- and 4-credit courses offered each semester (listed in department prior to preregistration; refer to *Time and Room Schedule*). Minimum of 4 credits required for teacher certification. For secondary teacher candidates, the appropriate methods course, taught in the department of the major, usually satisfies this requirement. Educ 703B is required for candidates for elementary teacher certification who do not complete 703C, D, F, or G. Prereq. for teacher certification students: Educ 500 and permission, which is accomplished by signing the appropriate course roster in the Teacher Education Office. Prereq. for students not seeking teacher certification: permission, as described above. 2 or 4 cr.

705. ALTERNATIVE PERSPECTIVES ON THE NATURE OF EDUCATION

A) Contemporary Educational Perspectives; B) Controversial Issues in Education I; C) Ethical Issues in Education; D) Concepts of Teaching: Differing Views; E) Curriculum Theory and Development; F) Readings on Educational Perspectives; G) Philosophy of Education; H) The Scope of Education; I) Education as a Form of Social Control; J) School Reform Theories; K) Schooling and the Rights of Children; L) Education, Inequality, and the Meritocracy; M) Readings in Philosophies of Outdoor Education; N) Alternative Perspectives on the Nature of Education; O) Classrooms: The Social Context; P) Teaching: The Social Context; Q) School and Society. Students formulate, develop, and evaluate their own educational principles, standards, and priorities. Alternative philosophies of education; contemporary educational issues. Variable credit modules offered each semester (listed in department prior to preregistration; refer to *Time and Room Schedule*). Minimum of 4 credits required for teacher certification. Prereq. for teacher certification students: Educ 500 and permission, which is accomplished by signing the appropriate course roster in the Teacher Education Office. Prereq. for students not seeking teacher certification: permission, as described above. 2 or 4 cr.

706. INTRODUCTION TO READING INSTRUCTION IN THE ELEMENTARY SCHOOLS

Reading process; current procedures and materials; diagnostic techniques; practicum experience. Course satisfies reading requirement for prospective elementary teachers in the five-year teacher education program and may be included in the 12 required graduate credits in education at the graduate level. Course may also be taken for undergraduate credit before entrance into fifth year; in this case the course satisfies reading requirement but is not applicable toward the 12 required graduate credits. Prereq: Educ 500. 4 cr.

707. APPROACHES TO TEACHING READING AT THE SECONDARY LEVEL

The Reading Curriculum in The Secondary School: structural components (developmental, corrective, remedial); materials and methods of instruction and appraisal; instruments of measurement and evaluation in the comprehensive secondary reading program. 2 cr. *Teaching Reading through the Content Areas: Alternatives and Application:* new approaches, concepts, and methodologies of teaching reading through content materials; procedures to develop and produce instructional strategies and materials for an integrated reading-content program. (Two credits of 707 may be used to satisfy 2 credits of Educ 700.) 2 cr.

733. INTRODUCTION TO THE TEACHING OF WRITING

The development of writers from child to adult; ways to respond to writing; organization of the classroom for the teaching of writing. Prereq: permission. 4 cr.

734. CHILDREN'S LITERATURE

Interpretive and critical study of literature for children in the elementary, middle, and junior high schools. Methods of using literature with children. 4 cr.

741. EXPLORING MATHEMATICS WITH YOUNG CHILDREN

A laboratory course offering those who teach young children mathematics and who are interested in children's discovery learning and creative thinking an opportunity to experience exploratory activities with concrete materials. It offers, on the adult level, mathematical investigations through which one may develop the ability to provide children with a mathematically rich environment, to become adept at asking problem-posing questions, and to establish a rationale for so doing. 4 cr.

750. INTRODUCTION TO EXCEPTIONALITY
Social, psychological, and physical characteristics of exceptional individuals including intellectual (gifted, retarded, learning disabled); sensory (visual, auditory); motor (orthopedic); health; and communication. Implications for educational and human service delivery. 4 cr.

751. EDUCATING EXCEPTIONAL LEARNERS
Issues in special education (labeling, mainstreaming, efficacy): techniques of special teaching (referral, assessment, observation, task analysis, profiling, selecting materials, intervention). Issues in special teaching (behavior modification, ability training). Primary application to mild and moderate handicaps. Co- or prereq: Educ 750 or permission. 4 cr.

752. DIAGNOSIS AND REMEDIATION OF LEARNING DISABILITIES
Terminology, etiology, common characteristics, and symptoms; theory and practice in gross-motor, visual, and auditory remediation; testing procedures used in diagnosis and remediation programs. 4 cr.

753. TEACHING CHILDREN WITH BEHAVIOR DISORDERS
Nature and scope of emotional disturbances and social maladjustment in children, including causes, characteristics, treatment implications, and educational problems. 4 cr.

755-756. DIAGNOSTIC-PRESCRIPTIVE TEACHING OF EXCEPTIONAL LEARNERS
A two semester course to develop teacher competence to analyze learners and learning environments, specify learner characteristics, and prescribe, implement, and evaluate special educational interventions. Applications in the areas of language, mathematics, reading, science, social studies, perceptual-motor, behavioral, adaptive, and social skills. Focus on mildly and moderately handicapped children in regular class and resource room. Prereq: Education 750 or 751 or 700J or 703I or permission. 4 cr.

760. INTRODUCTION TO YOUNG CHILDREN WITH HANDICAPS
The needs of children (birth to eight years) with handicaps or who are at-risk for handicaps. Strengths and special needs of handicapped children; causes, identification, and treatment; current legislation; parent and family concerns; program models. 4 cr.

763. INTRODUCTION TO EDUCATIONAL MEDIA
Educational media in the learning process; curricular integration of materials and equipment in the school library media center; design and implementation of learning systems that provide a framework for the development of individual skills. 4 cr.

764. TELEVISION AND THE YOUNG CHILD
Emergence of television as a cultural force; impact on development of the young child: physical, social, emotional, intellectual; past and present research studies; helping parents, teachers, and children become better television consumers; planning alternatives for more positive use of television technology. 4 cr.

775. DIAGNOSTIC TEACHING OF READING
Classroom implementation of diagnosis and remediation of reading difficulties; for teachers, counselors, administrators, and other school personnel. 4 cr.

776. READING FOR CHILDREN WITH SPECIAL NEEDS
Techniques and procedures for teaching reading to children with special learning needs: the mentally retarded; learning disabled; gifted, culturally diverse. Emphasis will be placed on the implications of providing reading instruction in the least restrictive alternative. 4 cr.

785. EDUCATIONAL TESTS AND MEASUREMENTS
Theory and practice of educational evaluation; uses of test results in classroom teaching and student counseling; introductory statistical techniques. 4 cr.

795, 796. INDEPENDENT STUDY
Juniors and seniors only, with approval by appropriate faculty member. Neither course may be repeated. 2 or 4 cr.

797. SEMINAR IN CONTEMPORARY EDUCATIONAL PROBLEMS
Issues and problems of special contemporary significance, usually on a subject of recent special study by faculty member(s). Prereq: permission. May be repeated for different topics. 1-4 cr.

Electrical and Computer Engineering (E E)

(For program description, see page 58)

CHAIRPERSON: Ronald R. Clark
PROFESSORS: Fletcher A. Blanchard, Jr., Ronald R. Clark, Albert D. Frost, Joseph B. Murdoch, John L. Pokoski, Alden L. Winn
ASSOCIATE PROFESSORS: Glen C. Gerhard, Filson H. Glanz, Donald W. Melvin, Paul J. Nahin, Kondagunta Sivaprasad
ASSISTANT PROFESSORS: L. Gordon Kraft, John R. LaCourse, W. Thomas Miller III
ADJUNCT PROFESSOR: Sidney W. Darlington

431. SPEECH, MUSIC, AND NOISE: THE SCIENCE OF SOUNDS
Physical nature of sound waves. Production of sounds by mechanical vibration in string instruments, drums, loudspeakers, or by air column resonances in horns and organ pipes. Characteristics of hearing; human perception of sound, loudness, pitch, and intensity. Speech communication and the acoustics of the classroom, theater, or concert hall. Noise, its control and reduction; criteria for the judgment of annoyance. Application of acoustics and noise control for environmental protection and in industry, transportation, biology, and medicine. Amplification, storage, and reproduction of sound. Open for credit to nonengineering and nonphysics students only. Prereq: high school mathematics. Lab. 4 cr.

432. LIGHT: SOURCES AND USES
Edison's lamp to the laser; production of light; color, the spectrum, and the human eye; sources of light; lenses and reflectors; the four factors of seeing; daylighting, energy, designing lighting installations. Lighting applications in interior spaces and outdoors. Open for credit to nonengineering and nonphysics students only. Prereq: high school algebra, trigonometry, and physics, or college courses in these. Lab. 4 cr.

517. JUNIOR LABORATORY I
Application of techniques in electrical engineering. Prereq: E E 551 taken concurrently. 1 cr.

518. JUNIOR LABORATORY II
Laboratory investigations synthesizing classroom knowledge in circuits, electronics, electromagnetics, and signal processing. Prereq: E E 517; E E 551. Pre- or coreq: E E 656. 3 cr.

531. ELEMENTS OF DIGITAL SYSTEMS
Fundamental design and analysis principles. Number systems, switching algebra, logic circuits, codes, and an introduction to digital computers. Laboratory: student-built systems using modern integrated circuit technology; "hands-on" experience with a minicomputer. For non-E E majors. Lab. 4 cr.

535. CIRCUITS AND SIGNALS
Circuit elements, signal waveforms, circuit laws and theorems, transfer functions, Laplace transforms, free, forced, and steady state responses, power. Non-E E majors only. Prereq: Math 426; Phys 408. Lab. 4 cr.

536. ELECTRONICS AND ELECTROMAGNETICS
Semiconductor diode and transistor theory and application, amplifiers and frequency response, magnetic fields and circuits, three phase, transformers, DC machines. Non-E E majors only. Prereq: E E 535. Lab. 4 cr.

541. ELECTRICAL CIRCUITS
Linear passive circuit theory. Circuit element characteristics. Fundamental circuit laws, equivalent circuits, power and energy relations, mesh and node analysis applied to resistive circuits. Transient and steady-state circuit analysis using Laplace Transform techniques, steady-state phasor AC circuit analysis. For E E majors only. Prereq: Math 426; pre- or coreq: Phys 408. Lab. 4 cr.

543. INTRODUCTION TO DIGITAL SYSTEMS
Fundamental design and analysis principles. Number systems, switching algebra, logic circuits, codes, and an introduction to digital computers. Laboratory: student-built systems using modern integrated circuit technology; "hands-on" experience with a minicomputer. For E E majors. Lab. 4 cr.

544. SIGNAL PROCESSING FUNDAMENTALS
Infinite series, differential calculus of functions of several variables. Vector differential and integral calculus with applications to electrostatics and magnetostatics. Prereq: Math 527. 3 cr.

545. ELECTRICAL NETWORKS
Two ports and transfer functions, time and frequency domain concepts, Fourier series and transforms, state equations, convolution, introductory network synthesis, passive and active filter design, approximation, and transmission lines. Prereq: E E 541. 3 cr.

546. PROBABILITY AND DISCRETE SYSTEMS
Emphasis on applied engineering concepts including probability, difference equations and discrete state models, z transforms, sampling, digital filters and discrete Fourier analysis. Prereq: E E 544; E E 545; Math 527. 3 cr.

548. CIRCUITS AND ELECTRONICS
Continuation of Electrical Circuits, including power in AC circuits, frequency response, and resonance. Linear active circuit theory. Topics include semiconductor devices and applications, bias design, amplifier behavior and modeling, special amplifiers, and amplifier frequency response. Prereq: E E 541. Lab. 4 cr.

551. ADVANCED ELECTRONICS I
Biasing circuits; thermal stability, power, small signal, and differential amplifiers; feedback theory, analysis and design. Sinusoidal oscillators, modulators, detectors, and analog circuits. Prereq: E E 548. 3 cr.

552. ADVANCED ELECTRONICS II
Circuit design for electronic instrumentation using both analog and digital devices from sensor to display. Discrete devices beyond the BJT and FET; practical limitations in Op-Amp circuits and Op-Amp configurations; basic digital devices; interfacing; transducers; signal amplification and processing; multiplexing and data transmission. Prereq: E E 543; E E 551. 4 cr.

603. ELECTROMAGNETIC FIELDS AND WAVES I
Maxwell's equations in integral and differential form; uniform plane waves in free space and material media; boundary conditions; simple transmission line theory; parallel plate and rectangular waveguides; simple radiating systems. Prereq: Math 527; Phys 408; E E 544 or equivalent. 3 cr.

604. ELECTROMAGNETIC FIELDS AND WAVES II
Loop antennas; aperture and cylindrical antennas; self and mutual impedence; receiving antennas and antenna arrays; bounded plane waves; rectangular and cylindrical waveguides; waveguide discontinuities and impedence matching; solid state microwave sources. Prereq: E E 603. 4 cr.

612. LOGICAL DESIGN OF DIGITAL COMPUTERS
Computer architecture, including arithmetic, memory, control, and input-output units; the trade-offs between hardware, software, and cost. "Hands-on" laboratory experience with machine language programming, interfacing of peripherals, etc., on minicomputers and microcomputers. Prereq: C S 410; E E 531 or 543; permission. Lab. 4 cr.

620. ELECTRONICS AND INSTRUMENTATION
For nonengineering and nonphysics students; no mathematical or engineering detail. Techniques for using electronic instruments and equipment. DC and AC circuits, electronic amplifiers, grounding

and shielding problems, transducers, electronic instruments, schematic reading, transients, noise problems, and digital techniques. Prereq: junior standing. 4 cr.

656. ELECTROMECHANICAL DEVICES
Magnetic circuits, theory and analysis of transformers, rotating machines, transducers and control system components, and other energy conversion methods. Prereq: E E 603; E E 548. Lab. 3 cr.

691,692. ELECTRICAL AND COMPUTER ENGINEERING SEMINAR
Includes periodically scheduled seminars presented by outside speakers and UNH faculty and graduate students. Topics will be in general areas of interest to electrical, electronics, and computer engineers. 1 cr. Cr/F.

695. ELECTRICAL ENGINEERING PROJECTS
Laboratory or advanced study course. Students either join a department research project or engage in a project in an area of staff interest. Prereq: acceptance by staff member. 1-4 cr.

700-level courses are offered subject to adequate student demand.

705. SEMICONDUCTOR DEVICES
Physical theory of semiconductors: models of solids, electronic properties, energy bonds, transport processes. PN junction theory, bipolar and field effect transistors, charge transfer devices, optoelectronic devices, integrated devices, and device fabrication technology. Prereq: Phys 505; E E 551; E E 603. 4 cr.

711. DIGITAL SYSTEMS
Advanced switching theory techniques; digital design tools; design of microprocessor-based systems; general design procedures, including top down design techniques, documentation, noise reduction, etc. Prereq: E E 612; permission. Lab. 4 cr.

714. MINICOMPUTER APPLICATIONS ENGINEERING
Organization and operation of minicomputer-based systems. Interfacing of special purpose peripherals, digital filters, system simulation, program and data organization, priority interrupt processing of tasks, real-time monitor systems. Applications to communication, automated-measurement, and process-control systems. Prereq: E E 531 or 543; programming experience; permission. Lab. 4 cr.

727. POWER SYSTEMS
Modeling and planning of electric power transmission systems. Prereq: E E 656; E E 545; permission. 4 cr.

741. FLUID CONTROL SYSTEMS
Mathematical modeling of hydraulic, pneumatic, and fluidic control elements and control systems. Methods for 1) analysis of systems using gases or liquids as the working fluid; 2) synthesis of the parameters of the control elements used in automatic control systems; 3) design of these systems. (Also offered as M E 741.) 4 cr.

745. FUNDAMENTALS OF ACOUSTICS
Acoustic wave equation for air; laws of reflection, refraction, and absorption; characteristics and measurement of acoustical sources; human perception of sound, loudness, intensity; microphones; acoustical materials; problems in environmental sound control; ultrasonics; architectural acoustics. Prereq: Phys 408; Math 527; permission. Lab. 4 cr.

757. FUNDAMENTALS OF COMMUNICATION SYSTEMS
Discussions of deterministic signals, Fourier spectra, random signals and noise, baseband communication, analog and digital modulation schemes, and system signal to noise ratio. Prereq: E E 545; permission. Lab. 4 cr.

758. COMMUNICATION SYSTEMS
Design of high-frequency communication systems. RF amplification, modulators for AM and FM systems, receiving techniques, antennas, free-space propagation, propagation characteristics of the ionosphere. Prereq: E E 603; E E 757 or equivalent; permission. Lab. 4 cr.

762. ILLUMINATION
Radiation; color and spectra; physics of light production; sources of ultraviolet, visible, and infrared energy; lamp circuitry; control of light; lighting design, daylighting, light and energy applications of light in business, industry, school, home, and outdoors. Open to juniors and seniors in engineering and physics. Prereq: permission. Lab. 4 cr.

775. APPLICATIONS OF INTEGRATED CIRCUITS
Design and construction of linear and nonlinear electronic circuits using existing integrated circuits. Laboratory course in practical applications of non-digital integrated circuit devices. Prereq: E E 552. 4 cr.

781. OCEAN INSTRUMENTATION
Analysis and design of instrumentation systems. Sensors, circuits, and devices for measurement and control. Elements of probability and statistics as applied to instrument design and data analysis. Transmission, display, storage and processing of information. The design, implementation, testing and evaluation of an ocean-related instrument system is an integral part of the course. Prereq: senior standing in E E or permission. 4 cr.

782. CONTROL SYSTEMS
Fundamental principles involved in the design and analysis of feedback control systems. Topics include stability criterion, time-domain analysis, frequency-domain analysis, and introduction to nonlinear systems. Prereq: permission. Lab. (Also offered as M E 782.) 4 cr.

783. BIOMEDICAL ENGINEERING
Engineering applied to cardiovascular, renal, gastrointestinal, sensory, reproductive, and other organ systems. Design and utilization of diagnostic monitoring, and prosthetic techniques and devices. Prereq: permission. Lab. 4 cr.

784. BIOMEDICAL INSTRUMENTATION
Principles of physiological and biological instrumentation design including transducers, signal conditioning, recording equipment, and patient safety. Laboratory includes the design and use of instrumentation for monitoring of electrocardiogram, electromyogram, electroencephalogram, pulse, and temperature. Current research topics, such as biotelemetry, ultrasonic diagnosis, and computer applications. Prereq: permission. Lab. 4 cr.

785. UNDERWATER ACOUSTICS
Vibrations, propagation, reflection, scattering, reverberation, attenuation, sonar equations, ray and mode theory, radiation of sound, transducers, and small- and large-signal considerations. Prereq: permission. 4 cr.

786. INTRODUCTION TO RADIO ASTRONOMY
Electromagnetic radiation, propagation. Positional astronomy and the radio sky, discrete radio sources, source-structure distribution, the sun as a radio source, flare and burst activity, planetary emissions, quasars, pulsars, techniques of observation and data reduction, radiometry, polarimeters, correlation interferometers, aperture synthesis. Prereq: senior or graduate status in engineering and physical sciences; permission. 4 cr.

787. HUMAN PHYSIOLOGICAL CONTROL SYSTEMS
Analysis of human physiological control systems and regulators through the use of mathematical models. Identification and linearization of systems component. Membrane biophysics. System interactions, stability, noise, and the relationship of system malfunction to disease. Prereq: permission. 4 cr.

796. SPECIAL TOPICS IN ELECTRICAL ENGINEERING
New or specialized courses and/or independent study. Prereq: permission. 2 or 4 cr.

Engineering Technology (E T)

(For program description, see page 60)

PROGRAM DIRECTOR: T. Antero Parssinen
ASSISTANT PROFESSORS: Kenneth H. Burt, David A. Forest, T. Antero Parssinen

Permission of instructor is a prerequisite to all engineering technology courses.

633. BUSINESS ORGANIZATION AND LAW
Corporations; proprietorships; product liability; contracts; O.S.H.A.; commercial paper; conditions of employment; I.R.S.; bankruptcy; U.C.C. 4 cr.

634. ECONOMICS OF BUSINESS ACTIVITIES
Elementary financial accounting; compound interest and time value of money; sources of capital; cost estimating; depreciation; risk and insurance; personal finance. 4 cr.

637. HEAT AND FLUID POWER I
Work and heat, first and second laws of thermodynamics, chemical reactions, heat engines and refrigerators; applied to various cycles (i.e., power plants, turbines, jet engines, etc.). Field trips. Lab. 4 cr.

638. HEAT AND FLUID POWER II
A continuation of 637 for MET students only. Further intensive applications of thermodynamics. Additional topics will include heat transfer and fluid dynamics. Lab. 4 cr.

641. PRODUCTION SYSTEMS
Production standards—sources, uses; manufacturing capacity—design, analysis; manufacturing inventories and their control; production scheduling; production control. 4 cr.

644. MECHANICAL ENGINEERING TECHNOLOGY CONCEPTS IN DESIGN AND ANALYSIS
Kinematics, kinetics, work and energy and vibrations. Intensive application of these concepts to problems in machine design. 4 cr.

645. INSTRUMENTATION
Statistics of experimentation; quantity standards and measurement; design of experiments; use of laboratory gear including dynamometer and viscosimeter; field trips. Lab. 4 cr.

651. MECHANICAL ENGINEERING TECHNOLOGY PROJECT
Group project; students required to find solutions to actual technological problems in design, fabrication, and testing as posed by industry. Student team defines the problem, prepares a budget, and works with the client company to research, design, build, and test the software and/or hardware needed. A year-long course: 4 cr. each semester, 8 cr. total; an "IA" grade (continuous course) given at the end of first semester. Withdrawal from course results in loss of credit.

671. DIGITAL SYSTEMS
A digital systems design and applications course using TTL and CMOS MSI and LSI devices. Topics include: logic design of memory systems, interfacing (serial and parallel), and an introduction to microcomputers. A digital design project is required. Lab. 4 cr.

674. CONTROL SYSTEMS AND COMPONENTS
Feedback, principles; stability, Nyquist criteria; performance charts; introduction to equalizer design; control system components. Analog computer simulations. Lab. 4 cr.

675. ELECTRICAL TECHNOLOGY
Electrical circuits—DC and AC network analysis; transformers; physical principles of electronic devices; power supplies; transistor amplifiers—frequency response; introduction to operational amplifiers and digital electronics; transducers and instrumentation systems. Lab. 4 cr.

677. ANALOG SYSTEMS
Op Amp specifications, instrumentation and bridge amplifiers, advanced Op Amp circuits and linear ICs. Interfacing techniques, and A/D and D/A converts. Lab applications. Lab. 4 cr.

680. COMMUNICATIONS AND FIELDS
Modulation and demodulation; noise, filter design, active filters and phase-lock loops; electric and magnetic fields; transmission lines; waveguide principles and components; antennas and radiation. Lab. 4 cr.

690. MICROCOMPUTER TECHNOLOGY
Microprocessors; their operation, programming, interfacing, and various uses. The 8080A/8085A is used as an operational model for hardware and software applications. SDK-85 microcomputer de-

velopment systems are used for lab. Microcomputer applications, with emphasis on lab work. Lab. 4 cr.

691. ELECTRICAL ENGINEERING TECHNOLOGY PROJECT
Group project; students are required to find solutions to actual technological problems in design, fabrication, and testing, as posed by industry. Student team defines the problem, prepares a budget, and works with the client company to research, design, build, and test the software and/or hardware needed. A year-long course: 4 cr. each semester, 8 cr. total, an "IA" grade (continuous course) given at end of first semester. Withdrawal from course results in loss of credit.

695. INDEPENDENT STUDY
A) Topics in Engineering Technology Mathematics; B) Topics in Mechanical Engineering Technology; C) Topics in Electrical Engineering Technology. 1-4 cr.

English (Engl)

(For program description, see page 27)

CHAIRPERSON: Carl Dawson
PROFESSORS: Thomas A. Carnicelli, Carl Dawson, Michael V. DePorte, Karl C. Diller, Robert Hapgood, Jean E. Kennard, Gary H. Lindberg, Terence P. Logan, Edmund G. Miller, Donald M. Murray, Philip L. Nicoloff, John C. Richardson, Charles D. Simic, Mark R. Smith, Thomas A. Williams, Jr., John A. Yount
ASSOCIATE PROFESSORS: Elizabeth H. Hageman, Andrew H. Merton, Hugh M. Potter III, Susan Schibanoff
ASSISTANT PROFESSORS: Janet Aikins, Mary Morris Clark, Lester A. Fisher, Melody G. Graulich, Rochelle Lieber, Mekeel McBride, Thomas R. Newkirk, Patrocinio P. Schweickart, David V. Siddall, David H. Watters, Ronald A. Winslow, Jr.
FACULTY IN RESIDENCE: Sarah Way Sherman

See departmental brochure for detailed descriptions of course offerings.
English 401 is a prerequisite for all English courses but 301 and 302 and 400.

301. IMPROVEMENT IN WRITING
Required of all students whose attainments in the fundamentals of English are found to be unsatisfactory. 0 cr. Cr/F. (Not offered every year.)

302. IMPROVEMENT IN READING
Intensive drill in reading skills for six weeks. 0 cr. Cr/F. (Not offered every year.)

400. ENGLISH AS A SECOND LANGUAGE
A course to improve the competence of foreign students in listening comprehension, speaking, reading, and writing. Recommended as preparation for Engl 401. Prereq: student should meet with and have the permission of the instructor. 4 cr.

401. FRESHMAN ENGLISH
Training to write more skillfully and to read with more appreciation and discernment. Frequent individual conferences for every student. 4 cr.

402. FRESHMAN SEMINARS: APPROACHES TO LITERATURE
Intensive study of a specific topic, theme, genre, major figure, or period of English or American literature. No credit toward the English major. For details, see the course descriptions available in the department office and from freshman advisers. 4 cr. (Not offered every year.)

501. INTRODUCTION TO PROSE WRITING
Nonfiction writing; weekly papers and frequent conferences. May be repeated for credit with the approval of department chairperson. 4 cr.

505. INTRODUCTION TO LINGUISTICS
An overview of the study of language: animal communication vs. human language, universal properties of human language, Chomsky's innateness hypothesis, language acquisition in children, dialects and language variation, language change. Includes an introduction to modern grammar (phonology, syntax, and semantics) and to scientific linguistic methodology. (Also offered as Ling 505.) 4 cr.

512. INTRODUCTION TO AMERICAN LITERATURE
Works of major American writers from Irving to Faulkner, with emphasis on how to adapt and present the material to high school English classes. Open only to English teaching majors. 4 cr. (Not offered every year.)

513, 514. INTRODUCTION TO ENGLISH LITERATURE
Selected classic works in poetry and prose considered in chronological order and historical context. Attention to the works and to the ideas and tastes of their periods. 513: Beowulf through 18th century. 514: 1800 to the present. 4 cr.

515, 516. A SURVEY OF AMERICAN LITERATURE
515: From the beginning of American literature to the Civil War. 516: from the Civil War to the present. 4 cr.

518. THE BIBLE AS LITERATURE
Literature of the Old and New Testaments and the Apocrypha, primarily in the King James version. 4 cr.

519. INTRODUCTION TO CRITICAL ANALYSIS
Critical analysis of fiction, poetry, and drama. Frequent short papers. Required of all English majors; should be taken early in their programs. 4 cr.

520. LITERATURE AND THE HISTORY OF IDEAS
An interdisciplinary study of literary works as influenced and illuminated by the concepts of philosophers, historians, and scientists. Barring duplication of subject, may be repeated for credit. 4 cr.

521. THE NATURE WRITERS
Fiction, poetry, and nonfiction books on the natural environment. Such books as Thoreau's *Walden* or *Maine Woods*, Leopold's *Sand County Almanac*, Beston's *Outermost House*, Dillard's *Pilgrim at Tinker Creek*, books by naturalists who observe nature vividly and knowingly and who write out of their concern for the environment. 4 cr.

522. AMERICAN LITERARY FOLKLORE
Folktales, songs, proverbs, beliefs, superstitions, and their use by such American authors as Irving, Hawthorne, Longfellow, Melville, Thoreau, Twain, Frost, and Faulkner; some emphasis on oral folk culture of New Hampshire. 4 cr.

523. MADNESS IN LITERATURE
How various writers depict insanity, and how they approach the problem of determining what attitudes and what behavior are truly sane. Emphasis on 19th- and 20th-century works, but works from earlier periods also considered. Euripedes' The *Bacchae*, Shakespeare's *King Lear*, Cervantes' *Don Quixote*, Hoffman's *The Golden Pot*, Dostoevsky's *Notes from the Underground*, Robbe-Grillet's *The Voyeur*, and Nabokov's *Pale Fire*. 4 cr.

525. POPULAR CULTURE IN AMERICA
Cultural expression in popular media. Verbal arts (best sellers, magazines, newspapers, speeches); some attention to television, film, comics, popular music. The multidisciplinary approach deals with historical context, cultural institutions, and distinctions between "popular arts" and "great literature." Recurrent images, situations, and themes will be investigated to see what values are celebrated and fears revealed. 4 cr.

533. INTRODUCTION TO FILM
Introduction to the art, history, technology, and theory of the narrative motion picture from the silent period to the present. Examination of films by such filmmakers as Griffith, Keaton, Eisenstein, Renoir, Welles, Hitchcock, Bergman, Kurosawa. (Also offered as ThCo 533; students not majoring or minoring in communication or in theater must register for Engl 533.) 4 cr.

585. INTRODUCTION TO WOMEN IN LITERATURE
Survey of images of women in literature. Content and approach vary depending on instructor. 4 cr.

586. INTRODUCTION TO WOMEN WRITERS
Survey of women writers. Content and approach vary depending on instructor. 4 cr.

595. LITERARY TOPICS
Various faculty members investigate topics of special interest at a level appropriate for nonmajors. See department for details of current offerings. 1-4 cr.

610. AMERICAN STUDIES: NEW ENGLAND CULTURE IN CHANGING TIMES
A team of three instructors from history, literature, and art investigate major contributions New England has made to American life. Focus on three periods: the Puritan era, 1620-90; the Transcendental period, 1830-60; and the period of emerging industrialism in the late 19th century. Prereq: second semester sophomore. (Also offered as Arts 610, Hist 610, and Huma 610.) Not for art studio major credit. 4 cr.

616. STUDIES IN FILM
Advanced, focused study of the cinema. Topics vary from year to year and with instructor. The focus may range from general consideration of film theory, film criticism, and film history, to specific analyses of selected genres, directors, and periods. (Also offered as ThCo 616; students majoring or minoring in communication or in theater must register for ThCo 616.) Prereq: Engl/ThCo 533 or permission. 4 cr.

619. CRITICAL APPROACHES TO LITERATURE
Selected methods of literary criticism applied to fiction, poetry, and/or drama with critical approaches varying from year to year. A follow-up of 519, course provides a second semester of training in critical reading and writing, examining such major modern strategies as formalist, biographical, archetypal, psychological, sociological, historical, feminist, and structuralist criticism. Prereq: Engl 519 or equivalent. 4 cr.

621, 622. NEWSWRITING
Workshops to develop reporting and writing skills. Prereq: Engl 501 or equivalent; written permission. May be repeated for credit with the approval of the department chairperson. 4 cr.

625, 626. WRITING FICTION
A workshop in the fundamental techniques of fiction writing. Student work is criticized by fellow students; individual conferences with instructor. Prereq: Engl 501 or equivalent. Written permission of instructor required for registration. May be repeated for credit with the approval of the department chairperson. 4 cr.

627, 628. WRITING POETRY
A workshop in the fundamental techniques of poetry writing. Class discussion and criticism of poems written by students. Individual conferences with instructor. Prereq: Engl 501 or equivalent. Written permission of instructor required for registration. May be repeated for credit with the approval of the department chairperson. 4 cr.

630. POETRY
Twentieth-century American and British poetry. Various poetic techniques and their demonstration. See course descriptions available in department office for further information. 4 cr. (Not offered each semester.)

631. THE DRAMA
Nature and types of drama illustrated by major English, American, and (translated) European plays. How to read a play. Live and filmed performances studied as available. 4 cr.

632. FICTION
Modern novels and/or short stories. The ways in which fiction communicates its meanings; the tools and methods at the fiction writer's disposal, primarily as they function in individual works. See course descriptions available in department office for further information. 4 cr. (Not offered each semester.)

650. STUDIES IN AMERICAN LITERATURE AND CULTURE
Special topics in American Studies, varying from year to year. 4 cr. (Not offered every year.)

651, 652. COMPARATIVE LITERATURE
Comparative studies of major authors representative of important periods of world literary achievement. 651: Homer to Dante; common themes and

the development of the epic tradition in early Western literature. 652: Renaissance to modern. Topics and approaches vary from semester to semester. 4 cr.

655. CHAUCER
A study of Chaucer's earlier works in the context of their continental sources and analogues. All readings in translation. 4 cr.

657. SHAKESPEARE
Ten major plays representative of the main periods of Shakespeare's career and the main types of drama which he wrote (tragedy, comedy, history). Live and filmed performances included as available. Restricted to undergraduates and designed for both English majors and students majoring in other fields. 4 cr.

685. WOMEN'S LITERARY TRADITIONS
Intensive study of theme, topics, and techniques in women's literature. Topics vary from year to year. 4 cr.

690. INTRODUCTION TO BLACK LITERATURE IN AMERICA
Selected prose, fiction, drama, and poetry. Individual works and historical-cultural background. Course will vary from year to year. 4 cr.

695, 696. SENIOR HONORS
Open to senior English majors who, in the opinion of the department, have demonstrated the capacity to do superior work; permission required. May be counted as two courses toward the ten that constitute a major in English. 4 cr. (Not offered every year.)

697, 698. ENGLISH MAJOR—SEMINAR
Intensive study of specialized topics which vary from year to year. Enrollment in each seminar is limited to 15 so that all students can take an active part in discussion and work closely with the instructor on their papers. Prereq: a grade of B or better in English 519 and permission. For details, see course description available in the department office. 4 cr.

701, 702. ADVANCED WRITING OF FICTION
Workshop discussion of advanced writing problems and readings of students' fiction. Individual conferences with instructor. Prereq: 625, 626, or equivalent; written permission of instructor required for registration. May be repeated for credit with the approval of the department chairperson. 4 cr.

703, 704. ADVANCED NONFICTION WRITING
A workshop course for students intending to write publishable magazine articles or nonfiction books. Equal stress on research and writing techniques. Prereq: Engl 621; 622 recommended. Written permission of instructor required. May be repeated for credit with the approval of the department chairperson. 4 cr.

705, 706. ADVANCED WRITING OF POETRY
Workshop discussion of advanced writing problems and submitted poems. Individual conferences with instructor. Prereq: Engl 627, 628, or equivalent. Written permission of instructor required for registration. May be repeated for credit with the approval of the department chairperson. 4 cr.

707. FORM AND THEORY OF FICTION
A writer's view of the forms, techniques, and theories of fiction. The novels, short stories, and works of criticism studied will vary, depending on the instructor. 4 cr.

708. FORM AND THEORY OF NONFICTION
A writer's view of contemporary nonfiction, emphasizing the choices the writer faces in the process of research and writing. 4 cr. (Not offered every year.)

709. FORM AND THEORY OF POETRY
A writer's view of the problems, traditions, and structures of poetry. 4 cr.

710. TEACHING WRITING
An introduction to various methods of teaching writing. Combines a review of theories, methods, and texts with direct observation of teaching practice. 2 or 4 cr.

712. CRITICAL ANALYSIS OF EXPOSITION
For the English teaching major; students analyze essays and write nonfiction prose. Variety of critical approaches; several methods of teaching composition. 4 cr. (Not offered every year.)

713, 714. LITERARY CRITICISM
Major critics from Plato to the present; the chief critical approaches to literature. 4 cr. (Not offered every year.)

715. APPLIED LINGUISTICS
Methods of teaching and learning foreign languages; background work on theories of language acquisition; the methodology of teaching English as a second language. Students interested in teaching other languages may do their projects on those languages. 4 cr.

716. PROBLEMS IN APPLIED LINGUISTICS
Variable topics course; problems such as language acquisition in children and adults, bilingualism, and linguistic field methods. 4 cr. (Not offered every year.)

718. ENGLISH LINGUISTICS
Introduction to the study of language; dialects and social and psychological problems of language; intensive work on the techniques of modern grammar (syntax, phonology, semantics). 4 cr. (Not offered every year.)

719. ENGLISH GRAMMAR
Traditional and contemporary approaches to the study of the structure of the English language: its history, phonology, morphology, syntax, including consideration of parts of speech, phrases, clauses, sentences, etymology, punctuation. Some emphasis on the teaching of English grammar. 4 cr.

720. NEWSPAPER INTERNSHIP
Students intending to pursue careers in journalism spend a semester working full- or part-time for a daily newspaper under close supervision of editors. Reporting is stressed, but students may do some

editing as well. The number of internships is very limited. Prereq: Engl 621 or its equivalent; permission. 4-16 cr.

741. LITERATURE OF EARLY AMERICA
Prose and poetry of the periods of exploration, colonization, early nationalism, Puritanism, Enlightenment. Individual works and historical-cultural background. 4 cr. (Not offered every year.)

742. AMERICAN LITERATURE, 1815-1865
Fiction, nonfiction, and poetry in the period of romanticism, transcendentalism, nationalism. Individual works and cultural background. 4 cr. (Not offered every year.)

743. AMERICAN LITERATURE, 1865-1915
Fiction, nonfiction, and poetry in the period of realism, naturalism, industrialism, big money. Individual works and cultural background. 4 cr.

744. AMERICAN LITERATURE, 1915-1945
Fiction, poetry, and drama in the period of avant-garde and leftism, jazz age, and depression. Individual works and cultural background. 4 cr.

745. CONTEMPORARY AMERICAN LITERATURE
A gathering of forms, figures, and movements since 1945. Individual works and cultural background. 4 cr.

746. STUDIES IN AMERICAN DRAMA
Topics vary from year to year. Examples: 20th-century American drama; contemporary playwrights; theatricality in American life. 4 cr. (Not offered every year.)

747. STUDIES IN AMERICAN POETRY
Topics vary from year to year. Examples: poets of the open road; Pound and his followers; major American poets; contemporary American poetry. 4 cr. (Not offered every year.)

748. STUDIES IN AMERICAN FICTION
Topics vary from year to year. Examples: the romance in America; the short story; realism and naturalism; the city novel; fiction of the thirties. 4 cr.

749. MAJOR AMERICAN AUTHORS
Intensive study of two or three writers. Examples: Melville and Faulkner; Fuller, Emerson, and Thoreau; James and Wharton; Dickinson and Frost. 4 cr.

750. SPECIAL STUDIES IN AMERICAN LITERATURE
Topics vary from year to year. Examples: the Puritan heritage; ethnic literatures in America; landscape in American literature; five American lives; pragmatism; American humor; transcendentalism; women regionalists. 4 cr.

751. MEDIEVAL EPIC AND ROMANCE
The two major types of medieval narrative; comparative study of works from England, France, Germany, and Iceland, including *Beowulf, Song of Roland, Niebelungenlied,* Gottfried's *Tristan, Njal's Saga,* and Malory's *Morte d'Arthur.* All works read in modern English translations. 4 cr. (Not offered every year.)

752. HISTORY OF THE ENGLISH LANGUAGE
Evolution of English from the Anglo-Saxon period to the present day. Relations between linguistic change and literary style. 4 cr. (Not offered every year.)

753. OLD ENGLISH
Introduction to Old English language and literature through the readings of selected poetry and prose. 4 cr.

754. BEOWULF
A reading of the poem and an introduction to the scholarship. Prereq: Engl 753. 4 cr.

755, 756. CHAUCER
755: *Troilus and Criseyde,* in the context of medieval continental literature by Boccaccio and other influences. 756: *The Canterbury Tales* in its original language. 4 cr.

758. SHAKESPEARE
A few plays studied intensively. Live and filmed performances included as available. 4 cr.

759. MILTON
Milton and his age. Generous selection of Milton's prose and poetry, with secondary readings of his sources and contemporaries. 4 cr. (Not offered every year.)

763. CONTINENTAL BACKGROUNDS OF THE ENGLISH RENAISSANCE
Major philosophers, artists, and writers of the continental Renaissance (in translation): Petrarch, Ficino, Pico, Vives, Valla, Castiglione, Machiavelli, Luther, Calvin, Rabelais, Montaigne, Cervantes, Erasmus, and Thomas More, as representative of the early English Renaissance. 4 cr. (Not offered every year.)

764. PROSE AND POETRY OF THE ELIZABETHANS
Shakespeare and his contemporaries. Major works, including Spenser's *Fairie Queene,* Sidney's *Astrophil and Stella,* Shakespeare's *Sonnets,* Marlowe's *Dr. Faustus*: their literary and intellectual backgrounds. 4 cr. (Not offered every year.)

765. ENGLISH LITERATURE IN THE 17TH CENTURY
Major writers of the 17th century, including Donne, Jonson, Herbert, Bacon, and Hobbes. 4 cr. (Not offered every year.)

767, 768. LITERATURE OF THE RESTORATION AND 18TH CENTURY
Representative works; texts studied closely; the ways they reflect the central intellectual problems of their age. 767: Dryden, Rochester, Restoration plays, Bunyan, Defoe, Montesquieu, and Swift. 768: Pope, Fielding, Johnson, Boswell, Voltaire, Sterne, Rousseau, Beckford, Diderot, and Blake. 4 cr.

769, 770. THE ENGLISH ROMANTIC PERIOD
Major literary trends and authors, 1798 to 1832. Focus on poetry but attention also to prose works and critical theories. 769: Wordsworth, Coleridge, Lamb, Hazlitt, DeQuincey; 770: Byron, Shelley, Keats. 4 cr. (Not offered every year.)

771, 772. VICTORIAN PROSE AND POETRY
Major writers; social and cultural history. Typically included in 771: Carlyle, Ruskin, Newman, Tennyson, Browning, and others; in 772: Arnold, the Pre-Raphaelites, Swinburne, Hopkins, and others. 4 cr. (Not offered every year.)

773, 774. BRITISH LITERATURE OF THE 20TH CENTURY
Poets and novelists; the concept of modernity in literature. Offerings vary by year and by instructor, but normally include such figures as Joyce, Lawrence, Yeats, Woolf, Forster, and more contemporary writers such as Burgess, Fowles, Murdoch, and Golding. 4 cr.

775. IRISH LITERATURE
Survey from the beginnings to present; works in Irish (read in translation) such as *The Cattle Raid of Cooley*, medieval lyrics, and *Mad Sweeney*; and works in English from Swift to the present. Twentieth-century authors: Joyce, Yeats, Synge, O'Casey, Beckett, and Flann O'Brien. 4 cr. (Not offered every year.)

778. BRAIN AND LANGUAGE
An introduction to neurolinguistics, a study of how language is related to the structure of the brain. The biological foundations of linguistic universals and language acquisition. Examination of evidence from aphasia and from normal language use. 4 cr.

779. LINGUISTIC FIELD METHODS
Devoted to the study, with use of an informant, of some non-Indo-European language that is unfamiliar to both the students and the instructor at the beginning of the class. The primary aim of the course is to give students a practical introduction to linguistic analysis without the support of a text. Theoretical concepts will be introduced as needed. 4 cr.

780. ENGLISH DRAMA TO 1640
Development of the drama through the Renaissance, emphasizing the Elizabethan and Jacobean dramatists. 4 cr.

781. ENGLISH DRAMA, 1660-1780
Representative plays, both serious and comic, by such writers as Wycherly, Congreve, Etherege, Goldsmith, Sheridan, Davenant, Dryden, Otway, Rowe, and Lillo. 4 cr.

782. MODERN DRAMA
Major English, American, and (translated) European plays of the modern period by such playwrights as Shaw, Ibsen, Chekhov, Strindberg, Pirandello, O'Neill, Brecht, Beckett, Williams, Miller, Pinter. Live and filmed performances studied as available. 4 cr. (Not offered every year.)

783. THE ENGLISH NOVEL OF THE 18TH CENTURY
The rise and development of the novel through study of selected major works by Defoe, Richardson, Fielding, Smollett, Sterne, and Austen. 4 cr.

784. THE ENGLISH NOVEL OF THE 19TH CENTURY
Representative novels from among Austen, Scott, Dickens, Thackeray, Emily Brontë, Charlotte Brontë, Trollope, George Eliot, Hardy, and Conrad. 4 cr.

785. MAJOR WOMEN WRITERS
Intensive study of one or more women writers. Selections vary from year to year. 4 cr.

790. SPECIAL TOPICS IN LINGUISTIC THEORY
An advanced course on a topic chosen by the instructor. Inquire at the English department office for a full course description each time the course is offered. Topics such as dialectology, Montague grammar, African linguistics, linguistics and literature, metrics, cross-disciplinary studies relating to linguistics. Also offered as Ling 790. Barring duplication of subject, may be repeated for credit. 4 cr.

792. TEACHING SECONDARY SCHOOL ENGLISH
Methods of teaching language, composition, and literature in grades 7-12. Required of all students in the English teaching major. Open to others with permission. 4 cr.

793. PHONETICS AND PHONOLOGY
The sounds and sound systems of English in the context of linguistic theory; comparisons of English to other languages. Also offered as Ling 793. Prereq: a basic linguistics course or permission. 4 cr.

794. SYNTAX AND SEMANTIC THEORY
The relationship of grammar and meaning as viewed from the standpoint of modern linguistic theory. Emphasis on the syntax and semantics of English, with special attention to the construction of arguments for or against particular analyses. Also offered as Ling 794. Prereq: a basic linguistics course or permission. 4 cr.

795, 796. INDEPENDENT STUDY
Open to highly qualified juniors and seniors. To be elected only with permission of the department chairperson and of the supervising faculty member or members. Barring duplication of subject, may be repeated for credit up to a maximum of 16 credit. 1-16 cr.

797, 798. SPECIAL STUDIES IN LITERATURE
A) Old English Literature; B) Medieval Literature; C) 16th Century; D) 17th Century; E) 18th Century; F) English Romantic Period; G) Victorian Period; H) 20th Century; I) Drama; J) Novel; K) Poetry; L) Nonfiction; M) American Literature; N) A Literary Problem; O) Literature of the Renaissance. The precise topics and methods of each section will vary. Barring duplication of subject, may be repeated for credit. For details, see the course descriptions available in the English department. 4 cr.

Entomology (Ento)

(For program description, see page 41)

CHAIRPERSON: G. Thomas Fisher
ASSOCIATE PROFESSORS: James S. Bowman, G. Thomas Fisher, R. Marcel Reeves
ASSISTANT PROFESSORS: John F. Burger, Donald S. Chandler, Paul C. Johnson
ADJUNCT ASSISTANT PROFESSOR: Siegfried E. Thewke

400. INSECTS AND MAN
Insects and their relations to man, his environment, and his activities. Not for major credit. 4 cr.

402. INTRODUCTORY ENTOMOLOGY
Insect structure and function, development, classification, ecology, behavior, and evolution for students in the biological sciences; importance of insects in terrestrial and aquatic ecosystems. Insect collection required. Lab. 4 cr.

503. PRINCIPLES OF APPLIED ENTOMOLOGY
Nature of destructive and beneficial insects and the fundamentals of insect pest management in our modern society. Elective for sophomores, juniors, and seniors. 4 cr.

506. FOREST ENTOMOLOGY
Especially for forest resources majors. Structure, development, classification, and control of representative forest insects. Insect collection required. Lab. 4 cr.

695. PROBLEMS IN ENTOMOLOGY
Problems and independent investigations in the various fields of basic and applied entomology. Prereq: Ento 402 and 503; permission. 2-4 cr.

704. MEDICAL ENTOMOLOGY
Survey of past and present trends in arthropod-borne diseases transmitted to human populations, emphasizing dynamics of arthropod-host-pathogen/parasite relationships, natural nidality of disease, and role of arthropods and other animals as reservoirs or vectors of disease and maintenance of zoonoses. Laboratory emphasizes survey of arthropod groups important as disease vectors or envenomizing humans. Elective for juniors and seniors. Lab. 4 cr.

705. SYSTEMATICS AND TAXONOMY OF INSECTS
The kinds and diversity of insects and their relationships, emphasizing methods of species and population analysis, concepts of classification and nomenclature, and application to identification. Prereq: Ento 402; Zool 412; /or permission. Lab. 4 cr.

706. SOIL ARTHROPODS
Biology and systematics of terrestrial arthropods, with emphasis on the springtails, sowbugs, myriapods, mites, spiders, and other arachnids. Prereq: permission. Lab. 4 cr. (Not offered every year.)

707. IMMATURE INSECTS
Identification of immature stages of insects, especially of holometabolus orders. Aquatic forms not included. Morphological features necessary for determination. Prereq: permission. 4 cr. (Not offered every year.)

709. AQUATIC INSECTS
Biology, ecology, and taxonomy of aquatic insects, including their role in succession and food webs of aquatic ecosystems, origin and evolution of adaptations to aquatic evironments and relationship between habitat type and faunal diversity. Laboratory emphasizes qualitative and semi-quantitative sampling techniques, collection and identification of principal aquatic groups. Prereq: Ento 402 or Zool 412; permission. Lab. 4 cr. (Not offered every year.)

710. INSECT MORPHOLOGY
External and internal anatomy of insects, with the integration of body structure and function. Prereq: permission. Lab. 4 cr. (Not offered every year.)

720. AGRICULTURAL ENTOMOLOGY
For advanced students interested in agribusiness. Economic insect pests on forage, fruit, and vegetable crops. Life cycles; damage and current methods of control. Prereq: permission. Lab. 4 cr.

721. PRINCIPLES OF BIOLOGICAL CONTROL
Natural and applied aspects of biological control of insect and plant pests. Prereq: permission. 4 cr. (Not offered every year.)

722. CHEMICAL CONTROL OF INSECTS
For advanced students in applied entomology. Review of the chemical compounds for insect control. Modes of pesticide entry; toxicology. Basic understanding of chemistry is desired. Prereq: permission. Lab. 4 cr

723. REGULATORY PEST CONTROL
For students preparing for careers dealing directly with or associated with the movement of agricultural commodities in internal and foreign trade. Legal documents; federal and state statutes. Prereq: basic entomology and plant pathology courses; permission. 2 or 4 cr. (Not offered every year.)

724. STRUCTURAL PEST CONTROL
For students wishing to study household and industrial entomology. Prereq: permission. Lab. 4 cr.

725. INSECT ECOLOGY
Role of insects in: coevolution of plant-herbivors and predator/parasite-prey system, ecosystem energetics, population dynamics, niche theory, competition, coexistence, diversity, and stability. Prereq: permission. Not for graduate credit. 3 cr. (Not offered every year.)

726. INTEGRATED PEST MANAGEMENT
Integration of pest management techniques involving biological, cultural, and chemical control with principles of insect ecology into a management approach for insect pests. Prereq: permission. Not for graduate credit. 3 cr. (Not offered every year.)

Environmental Conservation

(See Institute of Natural and Environmental Resources)

Environmental Engineering

(See pages 52, 54, 56)

Family and Consumer Studies (FCS)

(For program description, see page 42)

CHAIRPERSON: Michael F. Kalinowski
ASSOCIATE PROFESSORS: Larry J. Hansen, Victor R. Messier, Elizabeth A. Snell

ASSISTANT PROFESSORS: Jennifer W. Bryce, Elizabeth Dolan, Michael F. Kalinowski, Joel Rudd

455. INTRODUCTION TO CONSUMER STUDIES
Survey of consumer studies. Introduction to consumer decision making; consumer problems; consumer protection. 4 cr.

501. CONTEMPORARY ISSUES IN FAMILY AND CONSUMER STUDIES
Analysis of current issues and career opportunities; life and career planning. 4 cr. Cr/F (Fall semester only.)

525. HUMAN DEVELOPMENT
Developmental information from conception through death; theoretical perspectives and research methods in human development; emphasis on student's communication and analytical skills. 4 cr.

553. PERSONAL AND FAMILY FINANCE
Applied financial management; allocation of income to maximize wealth. Topics include banking, investments, credit, insurance. 4 cr.

555. MANAGEMENT AND DECISION MAKING
Theories of management, information processing, and decision making in the allocation of resources. 4 cr.

556. HOUSING AND DESIGN
Housing examined in terms of design, physical, socio-psychological, and community needs. 4 cr. (Not offered every year.)

615. FIELD EXPERIENCE
Work with agency, institution, or organization concerned with the welfare of families and individuals. Students will plan with department adviser and apply for approval. Prereq: approval of departmental faculty. 1-6 cr.

623. DEVELOPMENTAL PERSPECTIVES ON INFANCY AND EARLY CHILDHOOD
Integrative view of the developing child from conception through six years of age within the family context. Prereq: FCS 525. 4 cr. (Fall semester only.)

624. DEVELOPMENTAL PERSPECTIVES ON ADOLESCENCE AND EARLY ADULTHOOD
Developmental information from pubescence through early adulthood; the concept of identity and influences on identity formation. 4 cr. (Spring semester only.)

635. LEARNING IN CHILD DEVELOPMENT SETTINGS
Current theoretical approaches to communicating with children and influencing their behavior. Weekly four-hour laboratory experience working with preschool children is required at UNH Child-Family Center. Weekly three-hour seminar. Prereq: FCS 525; permission. 4 cr.

645. FAMILY RELATIONS
Theories and research relating to the family and its role in individual development. Prereq: FCS 525. 4 cr.

653. CONSUMER PROBLEMS
Examination of contemporary problems confronting consumers. 4 cr.

654. CONSUMER PROTECTION
Types of protection available to consumer. Agencies that have consumer mandates, the laws pertaining to them, their functioning, and their effectiveness. 4 cr.

664. CONSUMER BEHAVIOR
Survey of consumer behavior theory and research from economic, psychological, and sociological perspectives. Examination of the effects of business, marketing, and advertising strategies on purchase decisions. 4 cr.

695. INDEPENDENT STUDY
Scholarly project in the area of child, family, and consumer studies. Regular conferences with supervising faculty required. Prereq: approval of departmental faculty. 1-6 cr.

707. PRACTICUM
Supervised in-depth experience with observation and participation to increase the student's understanding in a specific area of Child, Family, or Consumer Studies. Choice of practicum from A) Child; B) Family; C) Consumer Studies. Prereq: FCS major; permission. 1-6 cr. Cr/F.

733. SUPERVISING PROGRAMS FOR YOUNG CHILDREN
Philosophical bases and theoretical rationales of various programs for young children; program alternatives and resources; issues in administration including supervision, finances, and regulations. Prereq: FCS 525; 623; 635. 4 cr. (Fall semester only.)

734. CURRICULUM FOR YOUNG CHILDREN
Designing and implementing developmentally appropriate activities for young children; assessing the effectiveness of activities; evaluating materials and equipment. Prereq: FCS 525; 623; 635; 733; permission. 4 cr. (Spring semester only.)

743. PARENTS, CHILDREN, AND PROFESSIONALS
Various professional roles relating to families; educational and therapeutic models of helping professions; focus on the relative roles of parents and professionals in enhancing child development. Prereq: FCS 645. 4 cr. (Fall semester only.)

744. APPLIED FAMILY SYSTEMS
Family systems theory; the dynamics of family systems and system change; educational strategies for working with families. Prereq: FCS 645; 743. 4 cr. (Spring semester only.)

753. FAMILY ECONOMICS
The impact of economic change on families, family income, and resource allocation. Prereq: one course in economics or permission. 4 cr.

754. CONSUMERS IN SOCIETY
Problems and issues facing selected groups of consumers: the elderly, the poor, children and adolescents, women, and others. Prereq: three courses in consumer studies or permission. 4 cr.

763. CONSUMER DECISION MAKING
Examination of individual and group consumer decision-making strategies and styles, including information acquisition, information processing, negotiation, and power. Prereq: FCS 555 or equivalent; permission. 4 cr.

782. FAMILY INTERNSHIP
Supervised experience in working with families. Students will spend a minimum of 20 hours a week in a selected program which offers educational services to families. Students must apply during the spring semester of their junior year. Prereq: FCS major; FCS 525; 623; 635; 645; 734; permission. Coreq: FCS 792. 8 cr. Cr/F. (Spring semester only.)

788. STUDENT TEACHING OF YOUNG CHILDREN
Supervised teaching experience. Students spend a minimum of 20 hours per week in a selected program for young children working with a cooperating teacher. Students must apply during the spring semester of their junior year. Prereq: FCS major; FCS 525; 623; 635; 645; 733; 734; 743; Educ 500 and 706; PhEd 675; ThCo 520; Math 621; permission. Coreq: FCS 798. 8 cr. Cr/F. (Spring semester only.)

791. METHODS OF TEACHING
Curriculum materials, methods, and resources in teaching. 4 cr.

792. SEMINAR FOR FAMILY INTERNS
This weekly seminar focuses on issues of concern to family internship students; provides advanced training in educational strategies for working with families; and develops students' professional skills. Prereq: admission to family internship program. Coreq: FCS 782. 4 cr. (Spring semester only.)

797. SPECIAL TOPICS
Highly focused examination of a particular theoretical, methodological, or policy issue in consumer studies. Prereq: permission of instructor. 4 cr.

798. SEMINAR FOR STUDENT TEACHERS
This weekly seminar supplements the student teaching experience and serves both as a forum for discussion of common concerns to student teachers and as a final, professional seminar. Prereq: admission to student teaching. Coreq: FCS 788. 4 cr. (Spring semester only.)

Forest Resources

(For program description, see page 44)

(See Institute of Natural and Environmental Resources)

French (Fren)

(For program description, see page 28)

CHAIRPERSON: Grover E. Marshall
PROFESSOR: Louis J. Hudon
ASSOCIATE PROFESSORS: Françoise G. Calin, Jack R. Vrooman
ASSISTANT PROFESSORS: Barbara T. Cooper, Grover E. Marshall, Jack A. Yeager
FACULTY IN RESIDENCE: Sharon R. Trachte
LECTURERS: Joan E. Howard, Bernadette Pallegoix

New students will be assigned to the proper course on the basis of their scores on the College Board Achievement Test. All courses are conducted in French unless otherwise noted. Junior and senior nonmajors may write papers and examinations in English in courses numbered 600 and above. Fren 519 is the first course counting toward a major. Students educated in French-speaking countries may not register for courses below the 700 level without permission. Transfer credit will not be given for elementary-level college courses in foreign languages if the student has had two or more years of the foreign language in secondary school.

401-402. ELEMENTARY FRENCH
For students without previous training in French. Aural comprehension, speaking, writing, reading. Labs. (No credit for students who have had two or more years of French in secondary school; however, any such students whose studies of French have been interrupted for a significant period of time should consult the department chairperson about possibly receiving credit.) 4 cr.

501. REVIEW OF FRENCH
Emphasis upon reading French texts with extensive oral/aural work in class and in lab. Review of basic grammar. Designed primarily for those whose study of French has been interrupted and for those who have had only two years of high school French. 4 cr.

503, 504. INTERMEDIATE FRENCH
Intensive critical reading of complete texts; formal review of grammar; survey of French civilization. Training in oral and written expression of ideas. Labs. 4 cr.

510. TOPICS IN FRENCH CIVILIZATION
Topics drawn from all aspects and periods of French civilization. Prerequisite depends on topic. Not for major credit. May be repeated for credit barring duplication of materials. 2 cr. (Not offered every year.)

512. TOPICS IN FRENCH CANADIAN/FRANCO-AMERICAN CIVILIZATION
Topics drawn from all aspects and periods of French Canadian/Franco-American civilization. Prerequisite depends on topic. Not for major credit. May be repeated for credit barring duplication of materials. 2 cr. (Not offered every year.)

514. FRENCH GRAMMAR AND SPEECH
Thorough review of grammar and practice in oral and written expression. Extensive use of language laboratory. Prereq: Fren 504. Not for major credit. 4 cr.

516. FRENCH CONVERSATION
Readings from current French periodicals and from material illustrating various aspects of contemporary France. Emphasis on increasing oral skills through class discussions and reports. Labs. Prereq: Fren 514 or grade of B (3.00) or better in Fren 504. Not for major credit. 4 cr.

518. READINGS FROM THE PERIODICALS OF FRENCH-SPEAKING COUNTRIES
Examination of articles drawn from current periodicals. Emphasis on political, economic, and cultural events. Prereq: Fren 504 or equivalent. May

be repeated for credit barring duplication of materials. 2 cr. (Not offered every year.)

519. READINGS IN FRENCH LITERATURE
Reading and rigorous oral and written analysis of selected texts. Prereq: Fren 504 or equivalent. Required for majors. 4 cr.

610. TOPICS IN FRENCH CIVILIZATION
Topics drawn from all aspects and periods of French civilization. Prereq: Fren 519. May be repeated for credit barring duplication of materials. 2 cr. (Not offered every year.)

612. TOPICS IN FRENCH CANADIAN/FRANCO-AMERICAN CIVILIZATION
Topics drawn from all aspects and periods of French Canadian/Franco-American civilization. Prereq: Fren 519. May be repeated for credit barring duplication of materials. 2 cr. (Not offered every year.)

620. THE NOVEL OF QUEBEC
Novel of Quebec as a reflection of a society, its attitudes and development. Readings in French. Taught in French or English as circumstances dictate. Papers and examinations in English for nonmajors. Prereq: Fren 504 or equivalent. 4 cr. (Not offered every year.)

621. FRENCH PROSE IN TRANSLATION
Works affecting French thought from the Renaissance to the modern period. Readings, discussion, papers in English. Not for major credit. 4 cr. (Not offered every year.)

622. FRENCH DRAMA IN TRANSLATION
Major works of comedy, tragedy, and drama. Molière and Racine to the present day. Readings, discussions, papers in English. Not for major credit. 4 cr. (Not offered every year.)

662. 17TH-CENTURY FRENCH LITERATURE
Prereq: Fren 519 or equivalent. Required for majors. 4 cr.

682. 20TH-CENTURY FRENCH LITERATURE
Prereq: Fren 519 or equivalent. 4 cr.

685-686. JUNIOR YEAR AT THE UNIVERSITY OF DIJON
Studies at the University of Dijon (France) for juniors who have completed their sophomore year at UNH and have passed with a grade of B or better Fren 514, Fren 519, and Fren 662. Students are expected to take French courses in each semester of their freshman and sophomore years. Attendance required at orientation sessions during the second semester of sophomore year. Interested students should consult the director of the program. Prereq: permission. (Not for graduate credit.) 32 cr. Cr/F.

755. THE FRENCH SHORT STORY
Prereq: Fren 519 or equivalent. 4 cr. (Not offered every year.)

758. FRENCH LITERATURE OF THE MIDDLE AGES AND RENAISSANCE
Prereq: Fren 519 or equivalent. 4 cr. (Not offered every year.)

765. 18TH-CENTURY FRENCH LITERATURE
Prereq: Fren 519 or equivalent. 4 cr. (Not offered every year.)

775. 19TH-CENTURY FRENCH LITERATURE
Prereq: Fren 519 or equivalent. 4 cr. (Not offered every year.)

780. STUDIES IN FRENCH POETRY
Prereq: Fren 519 or equivalent. 4 cr. (Not offered every year.)

790. ADVANCED LANGUAGE AND STYLE
Translation of literary texts, intensive study of principal techniques of style, explication de textes. Required for major. Prereq: at least two literature courses in French numbered above 682. 4 cr.

791. METHODS OF FOREIGN LANGUAGE TEACHING—FRENCH
Interdepartmental course. Objectives, methods, and techniques in teaching Spanish, French, German, and Latin from elementary grades through college. Discussion, demonstration, preparation of instructional materials, microteaching of the language skills. Prereq: permission. Not for major credit. (Also offered as AMLL 791.) 4 cr.

795, 796. SPECIAL STUDIES IN FRENCH LANGUAGE AND LITERATURE
Individual guided study of the work of a major author, a genre, or specific topics in literature. Training in bibliography and organization of material. Prereq: permission. 1-4 cr. (Not offered every year.)

798. SEMINAR IN FRENCH LITERATURE
Topics chosen by the instructor. May be repeated for credit barring duplication of material. Prereq: Fren 519; permission. 4 cr. (Not offered every year.)

Genetics (Gen)

(For program description, see page 81)

CHAIRPERSON: Yun-Tzu Kiang
PROFESSORS: James P. Barret, Walter M. Collins, Thomas P. Fairchild, Donald M. Green, Harold W. Hocker, Jr., Frank K. Hoornbeek, J. Brent Loy, Lincoln C. Peirce, Owen M. Rogers
ASSOCIATE PROFESSORS: Yun-Tzu Kiang, Subhash C. Minocha, Willard E. Urban, Jr., Robert M. Zsigray
ASSISTANT PROFESSORS: Roger A. Cady, Robert T. Eckert, Florence E. Farber
ADJUNCT ASSISTANT PROFESSORS: Maurice E. Demeritt, Jr., Peter W. Garrett

705. POPULATION GENETICS
Population growth and regulation; genetic variation; factors affecting gene frequency; ecological genetics. Prereq: principles of genetics or permission. 4 cr. (Not offered every year.)

706. GENETICS LABORATORY
Experiments and demonstrations in animal, plant, and microbial genetics and cytogenetics, including research techniques applicable to biochemical, population, and transmission genetics. Prereq: PlSc 604 or Zool 604; /or equivalent principles of genetics course. 3 cr.

740. EVOLUTIONARY BIOLOGY
Origin of life; source of genetic variation; population structure, mechanisms of evolution; molecular evolution; ecological adaptation in animals, plants, and man; community structure and evolution. 4 cr. (Not offered every year.)

771. BIOCHEMICAL GENETICS
Mechanisms of storage, replication, transmission, transcription, recombination, mutation, and expression of genetic information by cells and viruses. Prereq: Bchm 751 or permission. (Also offered as Bchm 771.) 3 cr.

772. INTRODUCTORY LABORATORY IN MOLECULAR GENETIC TECHNIQUES
Introductory laboratory in modern biochemical gene manipulation techniques including the genetic, physical, and enzymatic characterization of gene vectors, gene cloning, construction of genetic probes, and sequencing of nucleic acids. Prereq: Bchm 751-752; either Bchm 771 or Bchm 781 or Micro 804. (Also offered as Bchm 772.) 2 cr.

Geography (Geog)

(For program description, see page 28)

CHAIRPERSON: William H. Wallace
PROFESSOR: William H. Wallace
ASSOCIATE PROFESSOR: Robert G. LeBlanc
ASSISTANT PROFESSORS: Robert L. A. Adams, Alasdair D. Drysdale
ADJUNCT ASSOCIATE PROFESSOR: James W. Cerny

401, 402. REGIONAL GEOGRAPHY OF THE WORLD
Major culture areas of the world and the unique integration of human and physical phenomena that produces the distinctive character of these areas. 401: Western culture areas—Europe, the Americas, Australia, and New Zealand. 402: Non-Western culture areas—Black Africa, the Dry World, Oriental Asia, and the Pacific. 4 cr.

473. THE WEATHER
Introductory treatment of weather phenomena and the physical processes underlying those phenomena. Emphasis upon the nature and variability of New England weather. 4 cr.

512. GEOGRAPHY OF CANADA
Historical and regional geography of Canada. Historical growth; development of its distinctive regions; contemporary prospects and problems. Resource base, exploration, settlement, population growth, cultural contrasts, economic development, and special relationship with the U.S. Required 5-day field trip to Canada. 4 cr. Prereq: permission. (Not offered every year.)

513. GEOGRAPHY OF THE UNITED STATES
Geographical diversity of the U.S.: its physical setting, historical development, and contemporary spatial organization. Distinctive character and problems of major American regions; recent changes in economic, demographic, and social conditions. 4 cr. (Not offered every year.)

531. GEOGRAPHY OF WESTERN EUROPE AND THE MEDITERRANEAN
A regional and topical analysis of Western Europe and the Mediterranean. The geographical diversity of Europe in the context of physical setting and historical development. Present-day problems. 4 cr. (Not offered every year.)

540. GEOGRAPHY OF THE MIDDLE EAST
Environmental, cultural, political-geographic, and ecological foundations of the Middle East. Selected regional problems and issues; e.g., geographical dimensions of the Arab-Israeli conflict, oil, urbanization, population growth, and nomadism. 4 cr.

570. INTRODUCTORY CLIMATOLOGY
Characteristics and world distribution of present climates. Climates of the past and theories of climatic change. Selected topics in applied climatology. 4 cr.

572. PHYSICAL GEOGRAPHY
Factors in the formation and distribution of landforms, soils, and vegetation. Human significance of natural systems. Lab. 4 cr. (Not offered every year.)

581. CULTURAL GEOGRAPHY
Differentiation of the world in terms of population, race, language, religion, and economy. Emphasis on spatial and ecological analysis. 4 cr. (Not offered every year.)

582. ECONOMIC GEOGRAPHY
Areal variation of the earth in terms of production, exchange, and consumption of economic goods. Development and application of various theories of location. 4 cr. (Not offered every year.)

583. URBAN GEOGRAPHY
The spatial structure of cities and the city system. Emphasis on the North American city and its problems: land use, transporation, political fragmentation, physical environment, and residential patterns. 4 cr.

584. POLITICAL GEOGRAPHY
The interactions between geographic and political phenomena at the sub-national, national, and international levels. Emphasis on geographical aspects of current political problems within and between states. 4 cr.

590. INTRODUCTORY CARTOGRAPHY
Map usage, design, and execution; special-purpose thematic maps used in scholarly papers, theses, journals, and books. 4 cr.

610. THE GEOGRAPHY OF NEW ENGLAND
The distinctive physical setting of New England, its settlement and development during the past three centuries, and the present-day problems and opportunities of the region. Three required weekend field excursions near the end of the term. Prereq: permission. 4 cr. (Not offered every year.)

683. HISTORICAL GEOGRAPHY OF THE UNITED STATES
Spatial analysis of Indian economic life in 1492 and of European exploration, colonization, population change, economy, urbanization, and ethnicity to 1900. Geographic illusions and their significance. 4 cr. (Not offered every year.)

690. ADVANCED CARTOGRAPHY
Opportunity to pursue individual interests while sharing in the work of the instructor and other students. Map symbolization, map perception, computer mapping, map projection, surface analysis. Prereq: Geog 590 or permission. 4 cr. (Not offered every year.)

795. SPECIAL PROJECT IN GEOGRAPHY
Readings, library, archival, and field work. Primarily for geography seniors. Prereq: permission. 2 or 4 cr.

797. SEMINAR IN GEOGRAPHY
History of geographic thought, organizing concepts, and techniques of geographic analysis. Definition and investigation of research problems. Primarily for geography seniors. 4 cr. Cr/F.

Geology

(See Earth Sciences)

German

(See Ancient and Modern Languages and Literatures)

Greek

(See Ancient and Modern Languages and Literatures)

Health Administration and Planning (HAP)

(For program description, see page 67)

CHAIRPERSON: Lee F. Seidel
PROFESSOR: Basil J. F. Mott
ASSISTANT PROFESSORS: Marc D. Hiller, Richard J. A. Lewis, Michael J. O'Sullivan, John W. Seavey, Lee F. Seidel
ADJUNCT ASSOCIATE PROFESSORS: Francis J. Cronin, Donald E. Nicoll, Peter H. Patterson

400. INTRODUCTORY SEMINAR TO HEALTH ADMINISTRATION AND PLANNING
Introduces incoming majors to theories and practices embodied in the profession; facilitates understanding of it as a field of practice and an academic area of study. Seminar, field trips. Prereq: major. 1 cr.

401. HEALTH CARE SYSTEMS
Nature and functions of health care services and health professionals; impact of social, political, economic, legal, and technological forces. Current health problems. 4 cr.

402. PUBLIC HEALTH AND EPIDEMIOLOGY
Survey of the major environmental, communicable, genetic, and chronic health problems in the U.S. and the public response to them; introduction to the basic concepts and uses of epidemiology. 4 cr.

403. SEMINAR ON HEALTH AND MEDICAL CARE SYSTEMS
Focuses on health and how interactions between physical and social environment affect health; nature and function of medical care and public health services including impact of social, political, economic, legal, and technical forces. (Not open to students who have completed either HAP 401 or HAP 402.) 8 cr.

502. HEALTH AND MEDICAL CONCEPTS
Language and methodologies used by health clinicians in the prevention, diagnosis, and treatment of disease; medical sociology concepts of health professionals and organizations; efficacy of technological interventions. Prereq: major or permission. 2-4 cr.

600. SPECIAL TOPICS
A) Hospital Administration; B) Long-term Care Administration; C) Ambulatory Care Administration; D) Clinical Services Administration; E) Home Care Administration; F) Mental Health Administration; G–Z) Interdisciplinary. Prereq: junior major or permission. May repeat, but not duplicate subject areas. 1-4 cr.

621. PREPRACTICUM SEMINAR
Preparation for field practicum experience, orientation to experiential learning and competency development. Prereq: major. 2 cr.

622. HEALTH ADMINISTRATION AND PLANNING: FIELD PRACTICUM
Work experience in a hospital, nursing home, neighborhood health center, health-planning agency, or other health organization. Application of theories to practice. Supervision by agency personnel. Prereq: junior major; permission. Coreq: HAP 624. 10-16 cr.

630. ETHICAL ISSUES IN HEALTH CARE
Critical examination of ethical and legal issues confronting the health care professions and biomedical research/technology. Analysis of decision making as it affects the individual, the health care institution, and society. 4 cr. (Not offered every year.)

695. INDEPENDENT STUDY
In-depth study with faculty supervision. Prereq: permission of major adviser and faculty of the area concerned. 2-4 cr.

700. HEALTH ADMINISTRATION AND PLANNING: COMPETENCY ASSESSMENT
Examination and/or evaluation to determine level of competency within the five program competency areas. Normally students will be granted up to 12 credits each for competencies A-D (generic areas) and up to 16 credits for competency E (area of specialized interest). A. Describe, analyze, and interpret the context in which health services are delivered; including social, economic, political, professional, technical, and historical dimensions; B. Describe, analyze, and interpret the nature and functions of health institutions and programs, including their planning, financing, operation, and regulation; C. Apply qualitative and quantitative planning and administrative methodologies in the design, implementation, and evaluation of health policies and programs; D. Analyze, develop, and implement administrative and planning strategies for health services through the interactions among

health care and/or other human service organizations; E. Develop specialized knowledge of one or more health areas as related to institutions: hospitals and clinics, long-term care, primary care, planning, environmental health, regulation, health financing, insurance, and mental health. Prereq: major and permission. An instructor may assign an "IA" grade (continuing course) at the end of one semester. 0-64 cr. Cr/F.

701. HEALTH ADMINISTRATION AND PLANNING METHODS
Functions, productivity, and costs within health care organizations; market area analysis, utilization review, forecasting and scheduling, and quality assurance. Basic systems and operations management techniques. Prereq: major or permission. 2-4 cr.

702. HOSPITALS AND HEALTH CARE DELIVERY AGENCIES: INTERORGANIZATIONAL RELATIONS
Complex health problems and interorganizational response. Theories for evaluating and designing interorganizational systems. Prereq: major or permission. 2-4 cr.

704. FINANACIAL MANAGEMENT OF HEALTH-CARE INSTITUTIONS
Techniques and issues related to the financial dimension of health administration and planning. Prereq: major or permission. 2-4 cr.

721. HOSPITAL AND HEALTH SERVICES ADMINISTRATION
Theories and practices of administration in health care institutions; application and analysis of various administrative processes and techniques in a health context. Prereq: major or permission. 2-4 cr.

723. HEALTH PLANNING
Theoretical foundations for health planning; the historical evolution of current health planning; the interaction of health planning and regulation; and the application of health planning theory. Prereq: major or permission. 2-4 cr.

730. MANAGEMENT INFORMATION SYSTEMS IN HEALTH CARE INSTITUTIONS
Application of management information systems to medical and administrative problems of health care institutions. Concepts and techniques of systems design, implementation, and evaluation. 4 cr. (Not offered every year.)

732. ORGANIZATION OF HEALTH SERVICES: AN INVENTORY AND ANALYSIS
Identification and examination of institutions which comprise the health care system. Analysis of interaction of health organization with political, economic, and other social systems. Prereq: permission. 4 cr.

795. SENIOR INTEGRATING PAPER
Preparation of a research paper on a topic of significance to health administration and planning. Prereq: senior major; permission. 2 cr.

Health Studies

(See School of Health Studies)

History (Hist)

(For program description, see page 29)

CHAIRPERSON: Donald J. Wilcox
PROFESSORS: Charles E. Clark, Robert C. Gilmore, Hans Heilbronner, Charles A. Jellison, Jr., William R. Jones, David F. Long, Francis D. McCann, Jr., Robert M. Mennel, Darrett B. Rutman, John O. Voll, Douglas L. Wheeler, Donald J. Wilcox
ASSOCIATE PROFESSORS: Jeffry M. Diefendorf, Marion E. James, Allen B. Linden, Marc L. Schwarz, Harvard Sitkoff
ASSISTANT PROFESSOR: Janet L. Polasky

401. PRESENT IN PERSPECTIVE
Selected issues in contemporary life. Modern religious, cultural, and political topics from the viewpoint of the historian in an effort to see the present in a broader perspective. Western and non-Western experiences. 4 cr.

500. INTRODUCTION TO HISTORICAL THINKING
Basic skills essential to the study of history: critical reading of historical literature, improvement of written and oral analysis of historical material, and use of library resources. Intensive study of books and documents from varying historical fields and periods. Required of history majors; open to other interested students. 4 cr.

Group I. American History

403, 404. HISTORY OF THE UNITED STATES
American history from settlement to the present. Political, social, economic, and diplomatic aspects. Not open to students who elect Hist 510. 4 cr.

505, 506. AFRO-AMERICAN HISTORY
Experiences, aspirations, and contributions of Black Americans from their ethnic origins in Africa to the present American crisis in race relations; comparative study of cultures and institutions. 4 cr.

507. NATIVE PEOPLES OF THE AMERICAS
Surveys the societies of the peoples the Europeans called Indians and their reactions and interactions with the Europeans. The perspective is that the American continents experienced an invasion and conquest. While both continents will be dealt with broadly, the emphasis will be on North America. 4 cr.

510. HISTORICAL SURVEY OF AMERICAN CIVILIZATION
Topical survey, within broad chronological divisions, of the development of American civilization since 1600. Not open to students who elect Hist 403 or 404. 4 cr.

511. HISTORY OF NEW HAMPSHIRE
From presettlement times to the present, emphasizing the use of locally available materials and sources. 4 cr. (Not offered every year.)

603. EARLY AMERICAN HISTORY
The development of an Anglo-American society and culture along the eastern seaboard of North America, 1600-1750. 4 cr.

605, 606. AMERICA IN THE 18TH CENTURY AND THE REVOLUTION
American colonial and revolutionary history from 1740 through the adoption of the constitution and the establishment of Washington's first administration. 4 cr.

610. AMERICAN STUDIES: NEW ENGLAND CULTURE IN CHANGING TIMES
A team of three instructors from history, literature, and art investigate major contributions New England has made to American life. Focus on three periods: the Puritan era, 1620-90; the Transcendental period, 1830-60; and the period of emerging industrialism in the late 19th century. Prereq: second semester sophomore. (Also offered as Arts 610, Engl 610, and Huma 610.) Not for art studio major credit. 4 cr.

611, 612. 19TH-CENTURY AMERICA
Domestic and international factors in the development of the American republic, its institutions and people, from the inception of the new nation in 1789 to the emergence of the United States as a world power in 1900. 4 cr.

615, 616. 20TH-CENTURY AMERICA
U.S. after 1900; cultural, political, and social factors causing major changes in American life. Semester I: Progressivism through the New Deal. Semester II: World War II to the present. 4 cr.

619, 620. THE FOREIGN RELATIONS OF THE UNITED STATES
Primarily the history of American diplomacy, with attention given to the nondiplomatic aspects. Semester I: American Revolution to 1890. Semester II: 1890 to date. 4 cr.

621, 622. HISTORY OF AMERICAN THOUGHT
Significant American thinkers considered in their social context. Semester I: 1600 to 1860. Semester II: 1860 to present. 4 cr. (Not offered every year.)

624. AMERICAN URBAN HISTORY
Urbanization process from the colonial period to the present. 4 cr.

Group II. European History

435, 436. WESTERN CIVILIZATION
The classical origins and evolution of European civilization through the Renaissance, Reformation, and voyages of discovery. The rise of Europe to global supremacy in the 19th century and its transformation in the 20th century. 4 cr.

521. HISTORY OF SCIENCE (TO THE RENAISSANCE)
Prehistoric techniques, Pythagoreanism and Greek rationalism, concept of the universe, neo-Platonism and the Newtonian synthesis, history of atomism. 4 cr.

522. HISTORY OF SCIENCE (POST-RENAISSANCE)
Idea of the past, evolution; matter, energy, light; rise and decline of classical physical science; history of relativity and the quantum theory. Prereq: Hist 521 or permission. 4 cr.

559, 560. HISTORY OF GREAT BRITAIN
History of Great Britain from the earliest times to the present; from social, constitutional, economic, political, and intellectual perspectives. Designed for history students as well as those interested in literature, western political and social systems, American studies, education, and prelaw. 4 cr.

563. INTRODUCTION TO RUSSIAN CULTURE AND CIVILIZATION
A survey course, thematically organized, drawing upon Russian and Soviet literature, history, politics, art, and ideological currents to create a composite portrait of the evolution of Russian and Soviet culture. (Also offered as Russ 525.) 4 cr.

565. WOMEN IN MODERN EUROPE
A social history of women in Europe from 1700 to the present. The course will examine the development of the "modern nuclear family," transformations in women's work during the industrial revolution, and women's political evolution from bread rioters to hearth tenders to petitioners. Sources include published diaries, historiographical studies, and novels. 4 cr.

639, 640. THREE MEDIEVAL CIVILIZATIONS
Demise of classical antiquity in the lands bordering the Mediterranean, and the genesis and fruition of three new cultural traditions: Latin Christian, Islamic, and Byzantine. Religious, literary, and scholarly survivals and innovations from 400 A.D. to 1400 A.D. 4 cr.

641. AGE OF THE RENAISSANCE
The birth of the Renaissance, its economic, social, and political roots, and the flowering of Renaissance culture. Covers period from 1300 to 1600, with stress on Italy. 4 cr.

642. THE AGE OF REFORMATION
The reformation of church, society, and human values that shook Europe in the 16th century, and its roots in the 14th and 15th centuries. 4 cr.

647. FRANCE FROM LOUIS XIV THROUGH THE FRENCH REVOLUTION
Pressures and influences that led to the French Revolution. 4 cr.

648. MODERN FRANCE
French society from Napoleon to Mitterand. Topics include the Revolution of 1848 and the Paris Commune; World Wars and the Vichy regime; Existentialism, DeGaulle, and the Revolt of May-June 1968. 4 cr.

651, 652. EUROPEAN INTELLECTUAL HISTORY
European intellectual tradition from the Greek philosophers to the end of World War II. How basic ideas have developed out of previous modes of thought in response to new challenges. 4 cr.

656. 20TH-CENTURY EUROPE
World War I, European totalitarianisms, World War II, the loss of European primacy, and the search for a new Europe. 4 cr.

659. HISTORY OF MODERN SPAIN AND PORTUGAL
Iberian states and their peoples from the coming of liberalism to the present. Failure of Iberian liberalism and liberal government. Political and social change, imperial and intellectual movements, influence of Western European thought and activity. 4 cr.

661, 662. ENGLAND IN THE TUDOR AND STUART PERIODS
Political, religious, socio-economic, and intellectual forces for change at work in England from the accession of Henry VII to the revolution of 1688-89. 4 cr.

663. RUSSIA: ORIGINS TO MODERNIZATION
Russia from its foundation to emancipation and reform. Political developments, foreign relations, intellectual and ideological currents. 4 cr.

664. RUSSIA: FROM TSARIST TO SOVIET EMPIRE
The cost of modernization; Leninist and Stalinist revolutions; Soviet consolidation. 4 cr.

667. EARLY MODERN GERMANY: REFORMATION TO THE REVOLUTION OF 1848
Conflict between Holy Roman Empire and petty states; rise of Prussia; religious conflict and Enlightenment. 4 cr.

668. MODERN GERMANY SINCE 1848
Bismarck and Imperial Germany; Weimar and the rise of Hitler; post-World War II-divided Germany. 4 cr.

Group III. Non-Western History

421. WORLD HISTORY
Major world civilizations; interrelationships in time and space among the different human societies. Social, cultural, and political factors of the human experience. 4 cr.

531, 532. LATIN AMERICAN HISTORY
Semester I: Amerindian America and the European conquest and domination to the last half of the 18th century. Semester II: problems of identity, integration, and nationalism, with analysis directed at selected national areas (e.g., Brazil, Mexico, Argentina, and Cuba), plus attempts at generalization. 4 cr.

575. THE ANCIENT NEAR EAST
From the neolithic revolution to the time of Alexander the Great. Rise of civilization; nature of human artistic and intellectual development in the earliest civilizations of Mesopotamia and Egypt; Judaism in its historical setting. 4 cr.

576. THE AEGEAN WORLD
History of Greece and the Aegean area from Crete to the time of Alexander the Great in 323 B.C. 4 cr.

579, 580. THE HISTORY OF CHINA AND JAPAN
Civilizations of China and Japan from their origins to the present. Semester I: traditional civilizations of China and Japan to 1800. Semester II: the modernization of China and Japan after 1800. 4 cr.

585, 586. THE HISTORY OF THE MIDDLE EAST
From the time of Muhammad to the present. Semester I: origins and expansion of Islam and the nature of medieval Islamic civilization. Semester II: Ottoman history, relations with European powers, and emergence of modern nations in the Middle East. 4 cr.

587, 588. HISTORY OF AFRICA SOUTH OF THE SAHARA
From ancient times to the present. Semester I: from prehistoric times to 1870. Semester II: from 1870 to the present. African migrations, kingdoms and societies; African responses to the slave trade; Islam; European imperialism, colonialism, and industrialization; African nationalism, independence, and postindependence problems. 4 cr.

590. THE CITY IN HISTORY
The preindustrial and modern city as a philosophical and cultural institution, with emphasis on city design and architecture. Certain great cities, such as Athens, Florence, Paris of 1900, and Berlin of the 1920s, will be dealt with in detail. 4 cr.

631. LATIN AMERICAN HISTORY: REGIONAL OR COUNTRY STUDIES
Seminar; readings and discussions of literature relative to region or country being studied. See department listing for the current semester's topics. Students will be guided through preparation of a research proposal. Hist 531, 532 recommended. 4 cr.

632. LATIN AMERICAN HISTORY: TOPICAL STUDIES
Thematic seminar; reading and discussions of literature relative to selected topics. See the department listing for the current semester. Students will be guided through preparation of a research proposal. Hist 531, 532 recommended. 4 cr.

677. THE HELLENISTIC-ROMAN WORLD
The Mediterranean and Near East from the time of Alexander to the reign of Constantine. Covers the main political and social developments, but stresses artistic, scientific, philosophical, and religious trends, with particular emphasis on the rise of Christianity, Zoroastrianism, and the general religious climate that prepared the way for Islam. 4 cr.

681. HISTORY OF MODERN CHINA, 1839-PRESENT
Modernization of China. Political, social, and cultural changes that have occurred in China from its early contacts with the West. 4 cr.

683. RELIGION IN WORLD HISTORY
The religious experience of man from the perspective of world history. The major modes of religion; development of the major religious traditions and institutions. 4 cr.

684. HISTORY OF SOUTHERN AFRICA SINCE 1820
Struggle for political and economic control in the only region of Africa where European groups remain in power. Impact of European imperialism, European-settler nationalism, racial conflict, economic competition and industrialization, aparth-

eid, and assimilation with special attention to development of European hegemony. Official American policy. 4 cr.

685. THE MODERN MIDDLE EAST
From 18th century to the present. Problems created by modernization and reform of the traditional society; conservative reaction to reform, impact of nationalism, and appearance of new ideologies. 4 cr.

Group IV. Special Courses

595, 596. EXPLORATIONS IN HISTORY
See department listings for semester topic. 1-4 cr.

600. ADVANCED EXPLORATIONS IN HISTORY
See department listings for semester topic. Barring duplication of subject, may be repeated for credit. 1-4 cr.

695, 696. INDEPENDENT STUDY
A) Early American History; B) American National History; C) Canada; D) Latin America; E) Medieval History; F) Early Modern Europe; G) Modern European History; H) Ancient History; I) Far East and India; J) Near East and Africa; K) European Historiography; L) American Historiography; M) Russia; N) World History; O) English History; P) New Hampshire History; Q) Historical Methodology; R) Irish History. For students showing a special aptitude in history who desire to study an area or subject for which no appropriate course is offered. Prereq: permission. 4 or 8 cr.

774. HISTORIOGRAPHY
Analysis of ancient and modern historians. Required of all entering Ph.D. candidates; open to undergraduates with permission. 4 cr. (Not offered every year.)

775. HISTORICAL METHODS
Contemporary historical methods. Required of all entering Ph.D. candidates; open to undergraduates with permission. 4 cr. (Not offered every year.)

789. SEMINAR IN THE HISTORY OF SCIENCE
Selected topics conducted through special lectures, individual study, oral and written reports. Subject varies. Cannot be used for credit in history without permission of the department. Prereq: permission. 4 cr.

790. QUANTIFICATION AND COMPUTERS FOR THE HISTORIAN
The historian's use of computers and statistics; practical applications of both interactive terminal operations and batch processing. Data generation and processing, computer languages (BASIC, FORTRAN), programming and library programs, elementary statistics; students will undertake operations of their own on material supplied and will consider particular quantitative studies in history in terms of techniques used. No previous knowledge of computers or college mathematics required. Prereq: admission as an undergraduate major or graduate student in history; /or permission. 4 cr.

797. COLLOQUIUM IN HISTORY
Selected topics in American, European, and non-Western history. Required of history majors. Students must select section in the department office at the time of registration. 4 cr.

Home Economics

(See Family and Consumer Studies)
(See Nutritional Sciences)

Hotel Administration (Hotl)

(For program description, see page 78)

PROGRAM DIRECTOR: Melvin Sandler
ASSOCIATE PROFESSORS: Raymond J. Goodman, Jr., Neil Ross Porta, Melvin Sandler
LECTURER: Patrick Miller

403. FOOD AND BEVERAGE MANAGEMENT
Food service and lodging industry. Application of classroom principles through lectures, field trips, food labs, catering for on-campus functions, and participation in gourmet dinner productions. 4 cr.

556. MANAGEMENT OF PHYSICAL STRUCTURES
Components of physical structures as functional units. Lectures, guest speakers, and specialists related to design and construction. Students develop simulated hotel/motel construction projects. 4 cr.

618. FINANCIAL ANALYSIS AND CONTROL
Managerial accounting concepts and techniques applicable to hospitality and service industries. Prereq: Admn 403. 4 cr.

655. LODGING OPERATIONS MANAGEMENT
Management history, planning, organizing, leadership, training, current and future issues; students compare and contrast aspects of rooms division management in large and small hotels, including reservations, front office operations and acccounting, housekeeping, and auxiliary functions. 4 cr.

667. ADVANCED FOOD AND BEVERAGE MANAGEMENT
Integration of management principles and techniques. Presentation of large-scale gourmet dinners; serve as consultants to on-campus food service facilities; individual research projects. Prereq: Hotl 403. 4 cr.

671. BEVERAGE MANAGEMENT
Examination of purchasing, evaluation, storage, service, and control of alcoholic beverages. Emphasis given to wines, although beer, ale, distilled spirits, liqueurs, and mixed drinks are examined. Prereq: senior standing or permission. 4 cr.

695. INDEPENDENT ANALYSIS
Study and research project for honor students to advance knowledge in lodging and food services fields. Prereq: senior standing and permission. 2-16 cr.

698. TOPICS IN HOTEL ADMINISTRATION
Special topics and developments in lodging and food services industries. Prereq: senior standing and permission. 4 cr.

700. HOSPITALITY MARKETING MANAGEMENT
Provides opportunity to apply to lodging and food service industries the principles learned in basic marketing course. Lectures, guest speakers, projects. Prereq: Admn 651. 4 cr.

701. HOSPITALITY INDUSTRY PROJECTS
Industry consultation projects that fulfill an organization's need while providing students with problem analysis and decision opportunities. Client reports and presentations are required. Prereq: senior standing or permission. 4 cr.

702. HOTEL DEVELOPMENT
Financial management, business planning, and data processing principles and applications in hotels and restaurants. Students will apply techniques learned in class through use of a microcomputer and the development of a comprehensive business plan. Prereq: senior standing or permission. 4 cr.

703. HOSPITALITY INDUSTRY BUSINESS POLICY
Capstone course interrelating and applying principles and concepts from Administration, Economics, and Hotel Administration courses. Cases, current industry information, field visits, and projects may be employed. Prereq: all hotel major requirements. 4 cr.

795. INTERNSHIP
Fieldwork in an organization for on-the-job skill development. Normally supervision is provided by a qualified individual in the organization, with frequent consultation by a faculty sponsor. A written report is required of the student. Internships may be part-time or full-time, with course credits assigned accordingly. 1-16 cr.

798. SEMINAR
Special topics in hotel administration covering material not normally covered in the regular curriculum. Prereq: permission. 1-4 cr.

Humanities (Huma)

(For program description, see page 29)

COORDINATOR: Warren R. Brown
COORDINATOR, HUMANITIES 401: Laurel T. Ulrich
CORE FACULTY: David S. Andrew, Arts; Rose T. Antosiewicz, Ancient and Modern Languages and Literatures; Warren R. Brown, Political Science; Richard J. Callan, Ancient and Modern Languages and Literatures; R. Alberto Casás, Ancient and Modern Languages and Literature; Charles E. Clark, History; David E. Leary, Psychology; Charles H. Leighton, Ancient and Modern Languages and Literature; Barbara S. Tovey, Philosophy; Laurel T. Ulrich, Humanities.

401. INTRODUCTION TO THE HUMANITIES
Modular course with changing theme. Typically includes twelve to fifteen different mini-courses in art, music, literature, philosophy, and history. Students assigned three modules after indicating preferences at initial class. May be repeated for credit if different sections taken. For current theme, see Humanities 401 Coordinator. 4 cr.

501. HUMANITIES: THE ANCIENT WORLD
Appreciation of literature, the arts, and philosophy. Roots of Western civilization: Homer, Greek tragedy, Plato, Aristotle, the Bible, Virgil. Weekly lecture series, slides, films, visit to Boston museums. 4 cr.

502. HUMANITIES: THE MODERN WORLD
Literature, philosophy, and art from Dante through the French and Russian realists. Dante, Castiglione, Machiavelli, Montaigne, Racine, Moliere, Pope, Goethe, Wordsworth, Zola, Tolstoy. Weekly lecture series, slides, films, visit to Boston museums. 4 cr.

503. HUMANITIES: THE 20TH CENTURY
Literature, philosophy, and art of Western civilization in the last hundred years. 4 cr.

595. SPECIAL STUDIES IN THE HUMANITIES
Selected topics not covered by existing courses, with subjects to vary. May be repeated for credit. 2 or 4 cr.

610. AMERICAN STUDIES: NEW ENGLAND CULTURE IN CHANGING TIMES
A team of three instructors from history, literature, and art investigate major contributions New England has made to American life. Focus on three periods: the Puritan era, 1620–90; the Transcendental period, 1830–60; and the period of emerging industrialism in the late 19th century. Prereq: second semester sophomore. (Also offered as Hist 610, Engl 610, and Arts 610.) Not for art studio major credit. 4 cr.

650. HUMANITIES AND THE LAW: THE PROBLEM OF JUSTICE IN WESTERN CIVILIZATION
Interdisciplinary modular course examines interpretations of the nature of justice, its origins, the role of the professional judiciary, and the relationship of law and ethics. Students take four successive 3½-week modules during the semester. Prereq: junior or senior standing or permission. 4 cr.

699. SENIOR PROJECT IN HUMANITIES
Independent study open only to senior humanities majors with individual project approved and supervised by faculty. 2-6 cr.

Hydrology

(See Institute of Natural and Environmental Resources)

Institute of Natural and Environmental Resources

(For program description, see page 42)

DIRECTOR: Owen B. Durgin
PROFESSORS: Richard A. Andrews, James P. Barrett, Gordon L. Byers, William H. Drew, Owen B. Durgin, Nicolas Engalichev, Francis R. Hall, John L. Hill, Harold W. Hocker, Jr., Edmund F. Jansen, Jr., William W. Mautz, David P. Olson

ASSOCIATE PROFESSORS: John E. Carroll, S. Lawrence Dingman, Robert D. Harter, Bruce E. Lindsay, Albert E. Luloff, Nobel K. Peterson, R. Marcel Reeves, Richard R. Weyrick
ASSISTANT PROFESSORS: William A. Befort, Robert T. Eckert, Theodore E. Howard, Donald R. Miller, Richard G. Parker, Roger P. Sloan, C. Tattersall Smith
ADJUNCT PROFESSORS: George E. Frick, Nelson L. LeRay, Jr.
ADJUNCT ASSOCIATE PROFESSORS: C. Anthony Federer, James W. Hornbeck, William B. Leak, Robert S. Pierce, Sidney A. L. Pilgrim, Betty Holroyd Roberts, Lawrence O. Safford, Charles F. Tucker
ADJUNCT ASSISTANT PROFESSORS: Maurice E. Demeritt, Jr., Peter W. Garrett, Mary K. Reynolds

Natural and Environmental Resources (INER)

400. INTRODUCTION TO THE INSTITUTE OF NATURAL AND ENVIRONMENTAL RESOURCES
A survey of the academic programs in the Institute of Natural and Environmental Resources. Each program area will present an overview of its subject matter, its application to natural resource management issues, current research in progress, and employment opportunities for program graduates. Required of all majors in INER undergraduate programs. Offered first half of fall semester. 0 cr. Cr/F.

503. WETLANDS RESOURCES
Examination of coastal and adjacent freshwater and estuarine wetlands from historical, destruction, and preservation perspectives. Daily and evening lectures, laboratories, and field work at the Shoals Marine Laboratory emphasize succession and investigation of dominant plant, insect, and vertebrate associations. Prereq: one full year of college-level biology. 1 cr. (Summers only.)

511. COMPUTATION METHODS IN NATURAL RESOURCES
Computer programming using BASIC on remote terminals to solve forestry and other natural resource problems. No credit if Math 403 is taken. Lab. 2 cr.

512. GULF OF MAINE ECONOMIC RESOURCES
Topics include fisheries management, oil and gas recovery, and ocean minerals mining. Lab and field work will include opportunity to observe and interview those professionally involved in harvesting marine resources in the Gulf of Maine. Offered as a one-week course at the Shoals Marine Laboratory. Prereq: intro economics course or permission. 1 cr. (Summers only.)

528. APPLIED STATISTICS I
Development of elementary statistical techniques through the analysis of prepared data. Continuous and discrete probability distributions; distributions of sample statistics; small-sample theory; regression; correlation; analysis of variance. Permission of instructor required for upper division students. 4 cr. (Not offered every semester.)

581. METHODS IN LAND SURVEYING
Principles and field methods of land surveying for the natural resource manager; measurement of distance, direction, and elevation; instrumentation and computation; legal aspects of land description and boundary. Prereq: FoRs 542 or permission. Lab. 4 cr.

595, 596. PROBLEMS IN NATURAL AND ENVIRONMENTAL RESOURCES
Students pursue field, laboratory, or library problems in natural and environmental resources that are not covered by other courses. A faculty consultant and a study topic must be chosen prior to registration for the course. In consultation with the faculty adviser, students are expected to select the problem area, create a bibliography for reflection, and find channels to actively pursue the topic. A professionally written paper is expected at termination of the study. May be repeated once for credit. Prereq: permission. 2-4 cr.

603, 605. ENVIRONMENTS OF NEW HAMPSHIRE
Societal and ecological modifications of New Hampshire environments from seacoast to alpine tundra, including the physical, biological, economic, and societal modifications of each system. Prereq: basic course in biology and economics;/or permission. 3 cr. (Summer Session only. Not offered every summer.)

604, 606. ENVIRONMENTS OF NEW HAMPSHIRE LAB
Techniques in collection and maintenance of plant, animal, and geologic specimens; demonstrations of the ecologic and environmental systems; use of audiovisual aids to learn the systems; and field observation and collection. Transportation fee. 2 cr. (Summer session only. Not offered every summer.)

609, 610. SEMINAR
Seminars arranged according to student needs: A) Community Development; B) Forestry; C) Hydrology; D) Resource Economics; E) Soils; F) Wildlife; G) Fire Ecology; H) Environmental Conservation; I) Coastal Zone Management. Optional lab/field trips. Prereq: permission. 1-3 cr.

611. COASTAL RESOURCE MANAGEMENT
Systematic and regional analysis of the environmental problems caused by human use and misuse of the coastal zone (estuaries, wetlands, salt marsh, beaches); alteration, destruction, and pollution of these environments. Some emphasis on coast and shoreline of the Northeast with fieldwork. Transportation fee. 4 cr.

615. LINEAR PROGRAMMING METHODS
Setting up and solving problems by the simplex and distribution methods; variation in linear programming methods with applications; nonlinear programming, discrete programming; and solving input-output and game-theory problems. Applications to firm and aggregate economic analysis. Prereq: elementary matrix algebra or permission. 4 cr. (Offered every third semester.)

635. CONTEMPORARY CONSERVATION ISSUES
How man's technology causes biological and social conflicts when applied to wild-land resources; multiple demands of game, timber, water, minerals, and soil ecosystems vs. economic growth. Elective. Not open to freshmen. 4 cr.

637. PRACTICUM IN ENVIRONMENTAL CONSERVATION
Independent participation in an environmental conservation activity in the area of the student's specialization. Individual or group project may be developed under the supervision of any faculty member within or outside INER or with supervisors in public and private agencies, upon approval of the course instructor. Research projects not acceptable. Prereq: senior standing in the environmental conservation program. Lab. 4 cr. Cr/F. (Fall semesters only.)

701. STATISTICAL METHODS I
Analysis of variance and general linear model; measured numbers, nature of statistical evidence, sampling distributions, and principles of statistical inference; application of specific linear models to given sets of data. Prereq: upper-divison undergraduate or graduate standing. 4 cr. (Not offered every semester.)

702. NATURAL RESOURCES POLICY
Contemporary issues in the management and allocation of natural resources; impact of humans on agricultural and forest lands, water, wildlife, fisheries, and minerals; historical perspective of current resource policies. Prereq: permission. 4 cr.

709. SOILS AND COMMUNITY PLANNING
Using a town plan and soils map, students develop reports for multiple urban and rural land-use—housing, sewage, recreation, transportation, runoff, etc. USDA soil classification system; Soil Conservation Service rating criteria; New Hampshire soils. Guest lecturers. Prereq: permission. 2 cr.

711. STATISTICAL METHODS II
Intermediate course; basic concepts of sampling, linear models and analyses for one-way and multiway classification, factorial arrangement of treatments, multiple regression, and covariance. Computer programs used in analyzing data. Examples from environmental sciences. Prereq: INER 528 or equivalent. Also offered as PlSc 711. 4 cr.

712. SAMPLING TECHNIQUES
Techniques of sampling finite populations in environmental sciences; choice of sampling unit and frame, estimation of sample size, confidence limits, and comparisons of sample designs. Prereq: INER 528 or equivalent. 2-4 cr.

713. QUANTITATIVE ECOLOGY
Applied quantitative techniques: basic concepts in probability and statistics applied to ecological systems; population dynamics; spatial patterns; species abundance and diversity; classification and ordination; production; and energy and nutrient flow. Additional credit for in-depth mathematical analysis of a particular topic. Prereq: introductory courses in calculus, statistics, and ecology. 3 or 4 cr.

718. LAW OF NATURAL RESOURCES AND ENVIRONMENT
For resource managers: the legal system pertaining to resource management, protection of the environment, and possibilities for future action. Prereq: INER 635 or REco 606 or permission. 3 cr. (Not offered every year.)

757. BASICS OF REMOTE SENSING
Fundamentals for application of photographic and nonphotographic sensors to information gathering in natural resource fields; emphasis is on the interpretation of aerial photographs. Applications to forestry, wildlife, land-use planning, earth sciences, soils, hydrology, and engineering. Transportation fee. Lab. 2 cr.

758. APPLICATIONS OF REMOTE SENSING
Applications of remote sensing to the student's disciplinary interest. Student projects developed using available conventional aerial photography or other imagery. Prereq: INER 757 or equivalent. Transportation fee. Lab. 2 cr.

795, 796. INVESTIGATIONS
A) Resource Administration; B) Resource Management; C) Resource Policy; D) Public Laws and Resources. May be repeated. Prereq: permission. 2-4 cr.

797. FOREST RECREATION SEMINAR
Recreational use of nonurban lands; economics of public and private developments; planning for state and private recreational use, social aspects. Class project. Prereq: junior standing; permission. 4 cr.

Community Development (C D)

(For program description, see page 42)

507. INTRODUCTION TO COMMUNITY AND COMMUNITY DEVELOPMENT
Principal theories and methods of community and community development; skills required to help people enhance the social and economic well-being of their communities. Institutional structures; change processes; citizen participation in decision making; and problem analysis in contemporary, non-metropolitan communities in New England. Lab. 4 cr.

508. APPLIED COMMUNITY DEVELOPMENT
Students work in an actual community, assisting individuals and groups to identify needs and problems, establish attainable and objective goals, assess requirements and resources, and formulate programs for development; methods of collection, analysis and integration of pertinent primary and secondary economic, social, political, and physical data for community development. Prereq: C D 507 or permission. Lab. 4 cr.

614. COMMUNITY PLANNING
Community planning process in non-metropolitan communities; practical application of planning techniques. Community components: housing, jobs, schools, recreation, transportation; community appearance and the administrative structure for planning. Use of planning tools: data gathering and analysis, the master plan, zoning and subdivi-

sion regulations, community development programs. Prereq: REco 411; C D 507; / or permission. 4 cr. (Not offered every year.)

627. COMMUNITY ECONOMICS AND FINANCE
Economic and financial factors affecting community and local government decisions. Emphasis on use of economic theory and analytical techniques to evaluate problems in contemporary New England communities and towns. Prereq: REco 411 or Econ 402. (Also offered as REco 627.) 4 cr. (Offered every other year.)

628. COMMUNITY CONFLICT AND CONSENSUS
Topics drawn from the literature on community stratification, conflict resolution, leadership, power, and development. Emphasis on historical and contemporary theory and research. May include class field research project. Prereq: C D 507; INER 528 or equivalent; and/or permission. 4 cr. (Offered every other year.)

705. PLANNED CHANGE IN NONMETROPOLITAN COMMUNITIES
Discussion and application of community development theory and principles using appropriate research methodologies. Areas of study chosen from: population growth, community planning and development, provision and distribution of services, rural-urban differences, and systems management. Emphasis on empirical research studies. Students may participate in community-development activities. May include placement in field agency. Prereq: C D 508; INER 701 or equivalent; permission. (Offered in even years only.) 4 cr.

710. COMMUNITY DEVELOPMENT SEMINAR
Seminars arranged to students' needs and offered as demand warrants: in-depth treatment of area, including classic works. May be repeated. 2-4 cr.

717. LAW OF COMMUNITY PLANNING
Common law and the Constitution with respect to property law, including eminent domain, land-use planning, urban renewal, and zoning. Makes the nonlawyer aware of the influence and operation of the legal system in community development. 4 cr.

795, 796. INVESTIGATIONS IN COMMUNITY DEVELOPMENT
Special assignments in readings, investigations, or field problems. May be repeated. Prereq: permission. 2-4 cr.

Forest Resources (FoRs)

(For program description, see page 44)

400. ORIENTATION IN FORESTRY
Presentations, class discussions, and projects directed toward providing understanding of studies in forestry and preparation for careers in forestry. Required of all new students in the forestry program. Offered in second half of fall semester, following INER 400. Transportation fee. 0 cr. Cr/F.

423. DENDROLOGY
North American forest trees: taxonomy, silvical characteristics, community relationships; major forest regions. Restricted to forest resources and wildlife management majors; others by permission of instructor. Must be taken concurrently with FoRs 425. 2 cr.

425. FIELD IDENTIFICATION OF TREES AND SHRUBS
Identification and nomenclature of important North American trees; emphasis on trees and associated woody species of the Northeast. Forest resources and wildlife management majors must take concurrently with FoRs 423. Transportation fee. Lab. 2 cr.

426. WOOD SCIENCE AND TECHNOLOGY
Wood microstructure: physical, chemical, and mechanical properties; characteristics of wood including those produced by growth and form (i.e., knots, cross-grained) and those produced by degradation (i.e., stain, decay); log and lumber processing and quality evaluation; preparation of wood for use, including drying, gluing, and protection against degrade. Transportation fee. Lab. 4 cr.

500. SUMMER WORK EXPERIENCE
Work in forestry or closely related field; must be performed under professional supervision or approved by forest resources faculty. Students are responsible for arranging their own experience. (Forest resources majors only.) May be repeated. 0 cr. Cr/F.

527. SILVICS
Ecological base of silviculture; evolution and genetics of forest trees; classification of forest communities; forest environment; forest biota. Transportation fee. Prereq: Bot 411 or 412; FoRs 425 or Bot 566; Soil 501 taken concurrently. Lab. 4 cr.

542. FORESTLAND MEASUREMENT AND MAPPING
Elementary measuring equipment and techniques; preparation of maps; public land survey; courthouse deed search. Two-week field session following spring semester. Transportation fee. (Forest resources and wildlife majors only.) 2 cr.

544. FOREST ECONOMICS
Supply and demand for forest products and services; forestry and the general economy; economics of the firm; microeconomics; taxation. Prereq: a course in principles of economics. 4 cr.

629. SILVICULTURE
Application of ecological knowledge to the control, establishment, composition, and growth of forest stands for economic purposes. Transportation fee. Prereq: FoRs 423 and 527. Lab. 3 cr.

630. FOREST HARVESTING AND SILVICULTURE
Harvesting and silviculture activities. Prereq: FoRs 629 or permission. Limited enrollment. 2 cr. Cr/F.

634. WILDLIFE ECOLOGY
Principles and factors affecting wildlife populations, including wildlife management techniques, population dynamics, identification, habitat requirements. Research project required. Prereq: basic course in biology, botany, or zoology; /or permission. Transportation fee. Lab. 4 cr.

644. FOREST MENSURATION
Basic sampling techniques used in natural resource inventories including field applications. Estimates of forest growth and yield. Prereq: calculus, statistics, computer programming, and elementary land surveying. Lab. 4 cr.

652. FOREST RESOURCES MEASUREMENTS AND MAPPING
Aerial photo type mapping and forest resources inventory: type identification and delineation, map construction, cruise design, and forest resources inventory. Two-week field session following spring semester. Transportation fee. (Forest resources majors, others by permission.) Prereq: FoRs 527 and 644. 2 cr.

660. FOREST FIRE PROTECTION
Forest fire prevention, behavior, and effective control; weather phenomena; other aspects of forest damage; fire effects and use. Prereq: FoRs 527 or 629; Soil 501. Transportation fee. Lab. 2 cr.

672. ECOLOGICAL ENERGETICS
Flow of energy through ecological systems; thermodynamics in biological systems; photosynthesis; respiration, trophic structure; productivity; ecological efficiency; human use of energy, present and future, and the effects on energy flow in the ecosystem. Prereq: an ecology course or permission. 4 cr.

695, 696. INVESTIGATIONS IN FORESTRY
A) Forest Ecology; B) Remote Sensing; C) Wood Products; D) Game Management; E) Mensuration; F) Forest Economics; G) Forest Management; H) Operations Control and Analysis; I) Recreation; J) Policy; K) Wildlife Physiology; L) Forest Genetics. Prereq: permission. 1-4 cr.

720. FOREST GENETICS
Genetics of forest tree improvement; variation in natural populations, breeding methods, physiological characters, quantitative data analysis. Prereq: PlSc 604 (Zool 604); FoRs 629; statistics; /or permission. Transporation fee. Lab. 3 cr. (Not offered every year.)

722. ADVANCED SILVICULTURE
Intensive silviculture of forest stands. Regeneration (e.g., alternative regeneration methods and site preparation); stand management (e.g., thinning schedules and fertilization). Prereq: FoRs 629 or equivalent; permission. Transportation fee. 3 cr. (Not offered every year.)

734. FOREST PROTECTION SEMINAR
Discussion and special problems based on principles and techniques of forest protection. Prereq: permission. 3 cr. (Not offered every year.)

737. GAME MANAGEMENT I
Biological characteristics, habitat requirements, research and management practices of upland game birds and big game animals. Several all-day field trips required (possibly on weekends) to New England wildlife areas. Transportation fee. Prereq: wildlife management major. Lab. 4 cr.

738. GAME MANAGEMENT II
Biological characteristics, habitat requirements, research and management practices of small game animals, furbearers, predators, and waterfowl. Several all-day field trips required (possibly on weekends) to New England wildlife areas. Transportation fee. Prereq: wildlife management major. Lab. 4 cr.

745. FOREST MANAGEMENT
Forest land ownership; management objectives; forest inventory regulation and economic analysis; forest administration; professional responsibilities and opportunities. Prereq: completion of junior year in forestry curriculum. Transportation fee. Lab. 4 cr.

753. OPERATIONS CONTROL AND ANALYSIS
Quantitative tools for decision making in forest resource management activities; capital investment analysis, break-even and marginal analysis, linear and dynamic programming, simulation, decision analysis. Prereq: calculus; forest economics; statistics; mensuration. Lab. 4 cr.

754. WOOD PRODUCTS MANUFACTURE AND MARKETING
Wood products from harvesting and procurement of raw material to finished product processes; management decisions, marketing, and promotion problems. All-day field trips to wood products manufacturing plants, and occasionally to associated harvesting operations, weather permitting. Transportation fee. Prereq: FoRs 426; /or permission. Lab. 4 cr.

755. REGIONAL SILVICULTURE AND FOREST MANAGEMENT
Extended field trip to another forest region. Prereq: senior standing; FoRs 745; /or permission. Limited enrollment. 2 cr. Cr/F.

764. FOREST INDUSTRY ECONOMICS
Business methods and economics in the forest industry; planning for minimum cost operations and profitable use of capital in a forest enterprise. Individual projects. Prereq: senior standing; permission. 4 cr. (Not offered every year).

798. FOREST RESOURCES MANAGEMENT SEMINAR
The integration of demands from human population changes and needs on forest productivity through planning. The recognition of environmental quality and ecological concepts as planning criteria. Class discussions and group planning. Prereq: FoRs 745. Lab. 4 cr.

Hydrology (Hydr)

(For program description, see page 45)

504. FRESHWATER RESOURCES
Major determinants of freshwater resources including: hydrologic cycle and water balance; precipitation; stream-flow measurement; pollution; water supply and sewage treatment; water resource development. Lab. 4 cr.

603. HYDROLOGY AND WATER MANAGEMENT
Engineering principles and the control of water; precipitation and stream-flow measurement, hydrograph development, estimating runoff from a watershed, and the design of structures to control this runoff. Instrumentation and problem analysis. Transportation fee. Lab. 4 cr.

705. PRINCIPLES OF HYDROLOGY
Physical principles important in the hydrologic cycle, including: basic equations, properties of water, movement of water in natural environments, formation of precipitation, relations between precipitation and streamflow, snow-melt, evapotranspiration, interception, infiltration, relations between groundwater and stream-flow, and hydrologic aspects of water quality. Problems of measurement and aspects of statistical treatment of hydrologic data. Transportation fee. Prereq: calculus. Lab. 4 cr.

710. GROUNDWATER HYDROLOGY
Principles for fluid flow in porous media with emphasis on occurrence, location, and development of groundwater but with consideration of groundwater as a transporting medium. Major topics include well hydraulics, regional groundwater flow, exploration techniques, and chemical quality. Laboratory exercises involve use of fluid, electrical, and digital computer models to illustrate key concepts. Prereq: 705 or permission Lab. 4 cr.

795, 796. INDEPENDENT WORK IN HYDROLOGY
A) Hydrology; B) Chemistry of Water; C) Water Resource Management. Student may choose topic and faculty consultant. 1-4 cr.

Resource Economics (REco)

(For program description, see page 45)

411. INTRODUCTION TO RESOURCE ECONOMICS
Organization and operation of the American economic system; role that resource use plays within that system. Essential elements of microeconomic principles; institutions and programs affecting resource use and the impact on environmental quality. Principles dealing with the economic operation of individual consumption and production units within the framework of supply, demand, price, and the economic principles of marginality. Major fields of resource economics are reviewed. Cannot be taken for credit after Econ 402 or equivalent. 4 cr.

501. AGRICULTURAL AND NATURAL RESOURCE PRODUCT MARKETING
Structure, organization, and performance of the business section in agriculture, forestry, and other local natural resource-based industries; commodity marketing systems; demand estimation, pricing policies, consumer characteristics, and related topics. Prereq: REco 411 or equivalent; /or permission. 4 cr. (Offered every third semester.)

504. MANAGEMENT OF FARM AND RELATED RESOURCE-BASED BUSINESS
Planning, operation, and control of the farm with emphasis on application for the commercial farmer. Prereq: REco 411 or equivalent; /or permission. Lab. 4 cr.

506. POPULATION, FOOD, AND RESOURCE USE IN DEVELOPING COUNTRIES
Economic, technical, cultural, social, and political factors that influence food supplies, nutrition resource use, employment, and income distribution in the developing countries; the population explosion; strategies for expanding food supplies; social and institutional constraints, strategies and policies for economic development. Prereq: REco 411 or equivalent. 4 cr. (Offered every third semester.)

606. LAND ECONOMICS AND USE
Economic and institutional factors affecting human use of land resources; historical discussion of land ownership patterns; supply and demand; production relationships; location and resource use; benefit-cost analysis; institutional restraints and planning for more efficient use of land. The real estate market and taxation. Prereq: REco 411 or equivalent. 4 cr. (Offered every third semester.)

611. MARINE RESOURCE ECONOMICS
Economic overview of the marine environment; interactions/conflicts surrounding this multiple-use resource. Economics of fisheries; marine recreation; offshore facilities; aquaculture; waste disposal. Prereq: REco 411 or Econ 402; /or permission. 4 cr. (Offered every third semester.)

627. COMMUNITY ECONOMICS AND FINANCE
Economic and financial factors affecting community and local government decisions. Emphasis on use of economic theory and analytical techniques to evaluate problems in contemporary New England communities and towns. Prereq: REco 411 or Econ 402. (Also offered as C D 627.) 4 cr. (Offered every other year.)

676. ECONOMICS OF WATER USE AND QUALITY MANAGEMENT
Economics of water use; role of government and policy agencies, water supply and demand, economic impact of water and water quality standards, alternatives in quality management, externalities, and methods of evaluation. Prereq: elementary biological or physical science (or Hydr 504); elementary economics. 4 cr. (Offered every third semester.)

706. ECONOMICS OF RESOURCE DEVELOPMENT
Resource scarcity and theories of economic development; major resource development problems of land and natural resources, urban-rural conflicting demands, and conservation and water supply; capital needs, externalities, and market failure. Prereq: intermediate economic theory. 4 cr. (Offered every third semester.)

710. RESOURCE ECONOMICS SEMINAR
Seminars arranged to students' needs and offered as demand warrants: A) Agricultural Economics and Food Policy; B) Rural Development; C) Marine Economics; D) Location of Economic Activity; E) Land and Water Economics; F) Quantitative Methods; G) Environmental Economics. In-depth treatment of area, including classic works. May be repeated. 2-4 cr.

756. REGIONAL ECONOMIC ANALYSIS
Concepts and methods of delineating regional economies, methods of measuring activity, regional development, and public policies. Emphasis on empirical research studies. Prereq: intermediate economic theory or permission. 4 cr. (Offered every third semester.)

795-796. INVESTIGATIONS IN RESOURCE ECONOMICS
Special assignments in readings, investigations, or field problems. May be repeated. A) Agricultural Marketing; B) Agricultural Production and Farm Management; C) Community Economics and Finance D) Economics of Population and Food; E) Land Economics; F) Marine Economics; G) Rural Economic Development; H) Regional Economics; I) Water Economics. Prereq: permission. 2-4 cr.

Soil Science (Soil)

(For program description, see page 46)

501. SOILS AND THE ENVIRONMENT
Physical, chemical, and biological aspects of soils in the environment. Labs coordinate with lectures. Transportation fee. Lab. 4 cr.

502. SOIL-PLANT RELATIONSHIPS
Soils evaluated in terms of requirements for optimum growth of plants. Emphasis on nutrient availability. Soils and world food problems. Transportation fee. Lab. 4 cr.

601. SOIL MORPHOLOGY
Study and description of New Hampshire soils in the field; standards of National Cooperative Soil Survey used; strong orientation to field work (10 outdoor labs) and the application of soil properties to forestry, plant science, soil science, community planning, and waste disposal on land. Prereq: Soil 501 or permission. Transportation fee. Lab. 3 cr.

602. CHEMICAL ANALYSIS OF SOIL
Methods of soil chemical analysis. Prereq: quantitative analysis; permission. Lab. 2 cr.

605. FOREST SOILS
Biome-soil interrelationships; chemical, physical, and microbiological properties of forest soils; uptake, cycling, and replacement of nutrients in undisturbed ecosystems and disruptions by human activities. Prereq: Soil 501; Bot 412; /or permission. Transportation fee. Lab. 4 cr. (Not offered every year.)

614. SOIL MANAGEMENT
Principles of tillage, moisture control, fertility maintenance, and conservation practices for the successful management of the soil. Prereq: Soil 501. Lab. Transportation fee. 3 cr. (Not offered every year.)

702. CHEMISTRY OF SOILS
Chemical composition of soil; colloidal phenomena and the exchange and fixation of elements, cation exchange capacity and source of negative charge; inorganic reactions in soil and their effect on soil properties. Prereq: one year of college chemistry or permission. 3 cr.

704. SOIL CLASSIFICATION AND MAPPING
Soil genesis, morphology, classification, and mapping; major classification systems used in the U.S. and throughout the world as they relate to human uses of the soil. Prereq: Soil 501; an introductory geology course; /or permission. Transportation fee. 4 cr.

795, 796. INDEPENDENT WORK IN SOIL SCIENCE
A) Soil-Plant Relationships; B) Physics of Soils; C) Chemistry of Soils; D) Soil Classification; E) Forest Soils. Prereq: permission. 1-4 cr.

Intercollege Courses (Inco)

598, 599. INDEPENDENT WORK-STUDY
(598 off-campus, 599 on-campus). These courses enable students to pursue a semester of independent study in disciplines not within the purview of a particular department. Students select the area in which they wish to work, create their own bibliography for reflection, and find their own channels to pursue the problem actively. Students must write a proposal identifying the manner in which they intend to pursue the study and obtain the sponsorship of a faculty member. The proposal, with the faculty sponsor's endorsement, should be submitted to the Teaching-Learning Committee of the appropriate college, via the college dean's office for approval.

Italian

(See Ancient and Modern Languages and Literatures)

Japanese

(See Ancient and Modern Languages and Literatures)

Latin

(See Ancient and Modern Languages and Literatures)

Linguistics (Ling)

(For program description, see page 30)

See also the list of courses approved for the major or minor at the linguistics entry in the front of this catalog.

505. INTRODUCTION TO LINGUISTICS
An overview of the study of language: animal communication vs. human language, universal properties of human language, Chomsky's innateness hypothesis, language acquisition in children, dialects and language variation, language change. Includes an introduction to modern grammar (phonology, syntax, and semantics) and to scientific linguistic methodology. (Also offered as Engl 505.) 4 cr.

506. INTRODUCTION TO COMPARATIVE AND HISTORICAL LINGUISTICS
Major language families (primarily Indo-European) and the relationships among languages within a family. Diachronic studies; methods of writing; linguistic change; glottochronology; etymological studies. Some language training and Ling 505 desirable. (Also offered as Clas 506.) 4 cr.

790. SPECIAL TOPICS IN LINGUISTIC THEORY
An advanced course on a topic chosen by the instructor. Inquire at the English Department office for a full course description each time the course is offered. Topics such as dialectology, Montague grammar, African linguistics, linguistics and literature, metrics, cross-disciplinary studies relating to linguistics. Barring duplication of subject, may be repeated for credit. Also offered as Engl 790. 4 cr.

793. PHONETICS AND PHONOLOGY
The sounds and sound systems of English in the context of linguistic theory; comparisons of English to other languages. Also offered as Engl 793. Prereq: a basic linguistics course or permission. 4 cr.

794. SYNTAX AND SEMANTIC THEORY
The relationship of grammar and meaning as viewed from the standpoint of modern linguistic theory. Emphasis on the syntax and semantics of English, with special attention to the construction of arguments for or against particular analyses. Also offered as Engl 794. Prereq: a basic linguistics course or permission. 4 cr.

795, 796. INDEPENDENT STUDY
A) Synchronic Linguistics; B) Diachronic Linguistics; C) Linguistic Theory. For students showing a special aptitude for linguistics who desire to pursue a line of inquiry for which no appropriate course is offered. All requests must be forwarded by the faculty sponsor to the director of the Interdepartmental Linguistics Committee. 1-4 cr.

Mathematics (Math)

(For program description, see page 60)

CHAIRPERSON: Richard H. Balomenos
PROFESSORS: Richard H. Balomenos, Homer F. Bechtell, Jr., David M. Burton, Arthur H. Copeland, Jr., A. Robb Jacoby, Loren D. Meeker, Eric A. Nordgren, James Radlow, Shepley L. Ross, Albert C. Shar, Robert J. Silverman, Donovan H. Van Osdol
ASSOCIATE PROFESSORS: Albert B. Bennett, Jr., William E. Bonnice, William E. Geeslin, Donald W. Hadwin, Robert O. Kimball, Berrian Moore, III, Samuel D. Shore
ASSISTANT PROFESSORS: Kenneth B. Constantine, Marie A. Gaudard

401. ELEMENTARY MATH I
Beginning algebra including integer operations, solving linear equations, graphing linear functions, solving linear inequalities, systems of linear equations, polynomials, rational expressions and equations, and exponents and radicals. Students with one or more years of college preparatory mathematics are not eligible for credit. 0 or 4 cr.

402. ELEMENTARY MATH II
Review of elementary algebra, exponents, polynomials, factoring, rational exponents, and absolute value. Solving linear and quadratic equations and inequalities; systems of equations and Cramer's Rule; radical equations. Linear functions and related notions (slope, distance, midpoint); quadratic functions. Graphing using translations, symmetry, and stretchings and shrinkings. Students with two or more years of college preparatory mathematics are not eligible for credit. Prereq: Math 401 or one year of high school algebra. 0 or 4 cr.

405. ELEMENTARY FUNCTIONS
The basic properties of exponential and logarithmic functions, trigonometric and inverse trigonometric functions, including graphing, equation solving, and identity relations. Students with three or more years of college preparatory mathematics are not eligible for credit. Prereq: Math 402 or two years of high school algebra. 0 or 4 cr.

419. EVOLUTION OF MATHEMATICS
Mathematics from antiquity to the present; origins of the various methods and branches. How and why mathematical concepts, such as number and geometry, evolved. Prereq: three college preparatory mathematics units. Credit toward a math major only in mathematics education. 4 cr.

420. FINITE MATHEMATICS
Topics selected from: logic, set theory, probability, linear algebra, linear programming, game theory, and graph theory. Not a preparation for calculus. Prereq: three college preparatory math units. No credit toward a math major. 4 cr.

Note: Students enrolling in Math 425 are given a test on algebra and trigonometry during the first week of the semester. Those doing unsatisfactory work in algebra are required to complete an assignment in the mathematics remedial center concurrently with the first half of Math 425. Those doing unsatisfactory work in trigonometry are required to complete a similar assignment before enrolling in Math 426.

425. CALCULUS I
Calculus of one variable covering limits; derivatives, and antiderivatives of algebraic, exponential, and logarithmic functions; applications include max-min and related rate problems. Instruction at various paces and a special testing program. Prereq: at least three college preparatory math units including trigonometry. 4 cr.

426. CALCULUS II
Second course in calculus of one argument including trigonometric functions, techniques of integration, and series. Lectures, individual assignments and a special testing program. Prereq: Math 425 and fulfillment of trigonometry requirements. 4 cr.

527. DIFFERENTIAL EQUATIONS WITH LINEAR ALGEBRA
Fundamental methods of solving first order equations, essentials of matrix algebra; higher order linear equations, and linear systems; series solutions; Laplace transforms; selected applications. Prereq: Math 425 and 426. 4 cr.

528. MULTIDIMENSIONAL CALCULUS
Partial differentiation; composite functions and chain rules; maximum and minimum; transformations; vector algebra; vector functions; gradient, divergence, and curl; curves and surfaces; multiple, line, and surface integrals; divergence, Green and Stokes theorems. Prereq: Math 425 and 426. 4 cr.

531. MATHEMATICAL PROOF
A course designed to introduce the student to the nature of mathematical proof. Subject matter will vary from section to section. Offered in the following subject matter areas: A) Logic and Set Theory;

B) Linear Algebra; C) Discrete Computational Mathematics; D) Calculus; E) Number Theory. Prereq: Math 426. 4 cr.

621. NUMBER SYSTEMS FOR ELEMENTARY SCHOOL TEACHERS
Counting and set concepts, whole numbers, fractions, negative numbers, real numbers, numeration systems, inductive and deductive reasoning. Mathematical laboratory approach. Prereq: permission. Major credit only for elementary mathematics education majors. 4 cr.

622. GEOMETRY FOR ELEMENTARY SCHOOL TEACHERS
Deductive systems, metric geometry, congruence, symmetry, parallelism, similarity, transformation, measurement, polygons and circles, polyhedra. Mathematical laboratory approach. Prereq: Math 621. Major credit only for elementary mathematics education majors. 4 cr.

623. TOPICS FOR ELEMENTARY SCHOOL TEACHERS
Logic, mathematical systems, permutations, combinations, probability, and introduction to statistics. Mathematical laboratory approach. Credit offered to mathematics majors in elementary education only. 4 cr. (Offered in alternating years.)

636. INTRODUCTORY APPLIED STATISTICS
This modular statistics course stresses application. Lectures are supplemented by tutors, use of the computer, and audio-visual aids. Three two-credit modules are available, each meeting for half a semester. Students enroll for one, two, or all three of these. The introductory module, Math 636A, is a prerequisite for each of the other two modules. Note: The deadline for dropping this course without academic liability is the fourth Friday after the course begins. 2-6 cr.

636A. Introductory Applied Statistics
Elementary probability, samples, populations, estimates, sampling distributions, confidence intervals, hypothesis testing. (No credit if credit has been received for Math 644 or 735.)

636B. Analysis of Variance and Regression
Analysis of variance for completely randomized, randomized block, and latin square designs. Correlation, simple and multiple regression. Prereq: Math 636A. (No credit if credit has been received for Math 644 or 735.)

636C. Chi Square and Nonparametrics
Contingency tables, tests of goodness of fit and independence. Basic nonparametric statistical tests. Prereq: Math 636A.

644. APPLIED PROBABILITY AND STATISTICS
Probability concepts, random variables, parameter estimation, hypothesis testing, correlation, and regression. Prereq: Math 426. (Credit will not be given for both Math 644 and Math 735.) 4 cr.

645. APPLIED LINEAR ALGEBRA
Applied matrix theory; eigenvalue problems and their applications in mathematics, physics, and engineering; systems of linear, ordinary, differential equations. Computer methods will be used. Prereq: C S 410F; Math 426. (Not for credit if credit received for Math 762.) 4 cr.

646. ANALYSIS FOR APPLICATIONS
Initial-boundary-value problems of mathematical physics; Sturm-Liouville problems; series expansions by orthogonal functions; Green's functions; numerical methods. Prereq: C S 410; Math 527-528. 4 cr.

647. COMPLEX ANALYSIS FOR APPLICATIONS
Complex numbers; complex integration; infinite series; contour integration; conformal mapping. Prereq: Math 528. 4 cr.

656. INTRODUCTION TO NUMBER THEORY
Unique factorization, linear and quadratic congruences, quadratic reciprocity law, arithmetic functions, quadratic forms, introduction to algebraic numbers. Prereq: Math 531. 4 cr. Offered in alternating years.

657. GEOMETRY
Advanced approach to fundamental properties of Euclidean and other geometries. Prereq: Math 531. 4 cr.

658. TOPICS IN GEOMETRY
Topics to be selected from among projective geometry, finite geometrics, convexity, transformational geometry, non-Euclidean geometry, and other areas of elementary geometry within the framework of modern mathematics. Prereq: Math 531. 4 cr. (Offered in alternating years.)

682. NONLINEAR DIFFERENTIAL EQUATIONS
Phase plane analysis of linear and nonlinear autonomous systems; solutions, paths, and critical points; nonlinear conservative systems; limit cycles; periodic solutions; approximate methods; stability of solutions; applications. Prereq: Math 527. 4 cr. Offered in alternating years.

696. INDEPENDENT STUDY
Projects of interest and value to student and department. Prereq: permission of faculty supervisor and department chairperson. 1-6 cr.

698. SENIOR SEMINAR
Exploration of mathematical topics outside the standard undergraduate curricula. Focus on problem solving, generation of problems, and explaining mathematical concepts. Prereq: Senior standing in Mathematics or Mathematics Education. 4 cr.

703. MATHEMATICS EDUCATION, K-6
Methods of teaching geometry and the basic operations; mathematics objectives; introduction to research in mathematics education; elementary curriculum projects. Prereq: Math 621 or equivalent. 2-4 cr.

735. PROBABILITY
Sample spaces (discrete and continuous); random variables; conditional probability; moments; binomial, Poisson, and normal distributions; limit theorems for sums of random variables. Prereq: Math 528. (Credit will not be given for both Math 644 and Math 735.) 4 cr.

736. STATISTICS
Sampling theory, parameter estimation, hypothesis testing, regression, analysis of variance, nonparametric methods. Prereq: Math 735. 4 cr.

737. DECISION THEORY AND BAYESIAN METHODS
Utility, decision problems, prior and posterior distributions, sufficiency, estimation and hypothesis testing, linear models and sequential sampling. Emphasis on applications to business and economics. Prereq: Math 735. (Also offered as Econ 737.) 4 cr. Offered in alternating years.

738. MULTIVARIATE STATISTICAL ANALYSIS
Multivariate distributions, estimation and hypothesis testing, principal components, canonical correlations, factor analysis, discriminant analysis. Prereq: Math 735 and either Math 645 or Math 762. 4 cr. Offered in alternating years.

739. LINEAR STATISTICAL MODELS
Estimation, testing, and diagnostic methods for linear regression; analysis of variance; and analysis of covariance. Some use of packaged statistical computer programs. Prereq: Math 644 or Math 736; and Math 645 or Math 762. 4 cr. Offered in alternating years.

740. NONPARAMETRIC STATISTICAL METHODS
Methods of nonparametric statistical inference for one-sample and two-sample problems, one-way and two-way layouts, correlation, and regression. Prereq: Math 644 or Math 736. 4 cr. Offered in alternating years.

745-746. FOUNDATIONS OF APPLIED MATHEMATICS I AND II
Basic concepts and techniques of applied mathematics. Fourier series and transforms, Laplace transforms, optimization, linear spaces, eigenvalues, Sturm-Liouville systems, numerical methods, conformal mapping, residue theory. Intended for graduate students in mathematics, engineering, and the sciences. Prereq: Math 527-528, or equivalent. 4 cr.

753. NUMERICAL METHODS AND COMPUTERS I
Use of scientific subroutine and plotter routine packages, floating point arithmetic, polynomial and cubic spline interpolation, implementation problems for linear and nonlinear equations, random numbers and Monte Carlo method, Romberg's method, optimization techniques, finite elements. Selected algorithms will be programmed for computer solution. Prereq: Math 426; C S 410 and C S 410F. (Also offered as C S 753.) 4 cr.

754. NUMERICAL METHODS AND COMPUTERS II
Mathematical software. Computer solutions of differential equations, finite differences vs. finite elements, eigenvalues and eigenvectors. Prereq: Math 527; C S 410 and C S 410F. (Also offered as C S 754.) 4 cr.

761. ABSTRACT ALGEBRA
Basic properties of groups, rings, fields and their homomorphisms. Prereq: Math 531. 4 cr.

762. LINEAR ALGEBRA
Abstract vector spaces, linear transformations and matrices, determinants, eigenvalues and eigenvectors. Not for credit if credit received for Math 645. Prereq: Math 761. 4 cr.

764. ADVANCED ALGEBRA
Topics selected from: rings, modules, algebraic fields, and group theory. Prereq: Math 761. 4 cr. Offered in alternating years.

767. ONE-DIMENSIONAL REAL ANALYSIS
Theory of limits, continuity, differentiability, integrability. Prereq: Math 426; Math 531. 4 cr.

768. ABSTRACT ANALYSIS
Metric spaces, function spaces, theory of uniform limits. Prereq: Math 767. 4 cr. Offered in alternating years.

769. MULTIDIMENSIONAL REAL ANALYSIS
Continuity and differentiability of mappings from n-space to m-space; multiple integrals; line and surface integrals. Prereq: Math 767; Math 645 or 762. 4 cr. Offered in alternating years.

776. LOGIC
Induction and recursion; sentential logic; first-order logic; completeness, consistency, and decidability; recursive function. Prereq: Math 531 (preferably section A). 4 cr. Offered in alternating years.

783. SET THEORY
Axiomatic set theory, including its history, Zermelo-Fraenkel axioms, ordinal and cardinal numbers, consistency, independence, and undecidability. Prereq: Math 531. 4 cr. Offered in alternating years.

784. TOPOLOGY
Open sets, closure, base, and continuous functions. Connectedness, compactness, separation axioms and metrizability. Prereq: Math 531. 4 cr.

785. ALGEBRAIC METHODS IN TOPOLOGY
An introduction to some of the methods of algebraic topology chosen from topology of manifolds, homology theory, knot theory. Prereq: Math 784 and/or Math 761. 4 cr. Offered in alternating years.

788. COMPLEX ANALYSIS
Complex functions, sequences, limits, differentiability and Cauchy-Riemann equations, elementary functions, Cauchy's theorem and formula, Taylor's and Laurent's series, residues, conformal mapping. Not for credit if credit received for Math 647. Prereq: Math 767. 4 cr.

791. MATHEMATICS EDUCATION
Methods of teaching mathematics in junior and senior high school; acquaintance with professional organizations and publications; and review of major curriculum projects. Prereq: Educ 500. 4 cr.

Mechanical Engineering (M E)

(For program description, see page 63)

CHAIRPERSON: Russell L. Valentine
PROFESSORS: Robert W. Corell, Godfrey H. Savage, Charles K. Taft, Russell L. Valentine, Asim Yildiz

ASSOCIATE PROFESSORS: E. Eugene Allmendinger, Wayne M. Beasley, Barbaros Celikkol, Frederick G. Hochgraf, David E. Limbert, Harvey Lyons, William Mosberg, M. Robinson Swift, John A. Wilson
ASSISTANT PROFESSOR: Kenneth Baldwin

401. INTRODUCTION TO MECHANICAL ENGINEERING
Goals and interactions of mechanical engineering in contemporary society. Basic concepts presented and developed as background for future course work. Lectures, case studies, and laboratories. 4 cr.

441. ENGINEERING GRAPHICS
Fundamentals of engineering drawing and descriptive geometry developed for graphical communication of technical information and solution of spatial problems. 4 cr.

503. THERMODYNAMICS I
Laws of thermodynamics and their relation to working substances. Prereq: Math 426. 4 cr.

504. THERMODYNAMICS II
Laws of thermodynamics and their application to real systems. Behavior of ideal and real media; thermodynamics of nonreactive and reactive mixtures; power and refrigeration cycles. Prereq: M E 503. 4 cr.

505. INTRODUCTION TO THERMODYNAMICS AND HEAT TRANSFER
First and second laws of thermodynamics; selected applications. Elementary topics in conductive, radiative, and convective heat transfer. Not for M E majors. Prereq: Math 425; Phys 407. 4 cr.

508. FLUID DYNAMICS
Dynamics and thermodynamics of compressible and incompressible fluid flow; behavior of fluids as expressed by hydrostatic, continuity, momentum, and energy equations. Prereq: M E 503; M E 527. 4 cr.

523. INTRODUCTION TO STATICS AND DYNAMICS
An overview of statics and dynamics; two- and three-dimensional force systems; laws of equilibrium; moments of area; volume; inertia; stresses and strains; particle and rigid body dynamics; fixed and moving reference frames; impulse-momentum principles; work-energy relationships. Prereq: Math 426; Phys 407. Not for M E majors. 3 cr.

525. MECHANICS I
An introduction to statics. Two- and three-dimensional force systems, the concept of equilibrium, analysis of trusses and frames, centroids, bending moment and shear force diagrams, friction, and stress-strain relationships. Prereq: Math 425 and 426; Phys 407. 3 cr.

526. MECHANICS II
An introduction to strength of materials. Analysis of members under torsion, axial, shear and bending stresses, superposition of stresses, stability of columns. Prereq: M E 525. 3 cr.

527. MECHANICS III
An introduction to particle and rigid body dynamics. Rectilinear and curvilinear motion, translation and rotation, momentum and impulse principles, and work-energy relationships. Prereq: M E 525 or permission. 3 cr.

541. MANUFACTURING PROCESSES AND DESIGN
Manufacturing drawings, sketching basic mechanisms found in machine shops, operation of basic machine tools. Lab. 4 cr.

561. INTRODUCTION TO MATERIALS SCIENCE
Theoretical and experimental studies of the structure and properties of solids. Prereq: Chem 405 or equivalent. 3 cr.

561L. INTRODUCTION TO MATERIALS SCIENCE (LABORATORY)
Companion laboratory to M E 561. Co- or prereq: M E 561 or equivalent. 1 cr.

562. INTRODUCTION TO MATERIALS ENGINEERING
Physics and chemistry of selected processes in materials technology. Phase transformation in ceramics and ferrous alloys, sintering, solidification, semiconductor device fabrication. Extended lab hours for plant visits. Lab. 4 cr.

628. INTRODUCTION TO VIBRATIONS
Theory and application of mechanical and system vibrations. Single and multiple degrees of freedom; free and forced systems; development of closed form or approximate solutions using mathematical techniques and the computer. Introduction to continuous systems. Prereq: M E 527 or equivalent. 3 cr.

643-644. ELEMENTS OF DESIGN I AND II
Analysis, synthesis, and design of machine elements, and systems. Development of engineering judgment; selection of materials; stress and failure analysis; kinematic arrangements; design for finite and infinite life. Requires a final design project unifying course topics. Prereq: M E 526; M E 527; M E 561. 4 cr.

648. INTRODUCTION TO MEASUREMENT AND EXPERIMENTAL METHODS
Required for junior M E students. Experimental methods, transducers, signal-processing instrumentation, and experimental errors. Experiments involving the static and dynamic measurements, display and minicomputer processing of mechanical variables using typical mechanical and electrical transduction and signal handling methods. Prereq or coreq: E E 536. 3 cr.

655. DESIGN PROCESS AND PROJECT EXPERIENCE
Introduction to design and product development processes, using industrial examples and formal product development engineering case histories. Technical proposal writing, budgeting, and project planning using critical path method. Design process experience in a project team effort to reach a specific design goal. Prereq: senior M E major. May take for 3 credits or may attend the lectures only, for 1 credit, and take at least 2 credits in an alternative project experience or research course such as M E 695, 696, or 752, or Tech 697. 1 or 3 cr.

691. ECONOMIC DECISION MAKING IN ENGINEERING
Economic optimization of engineering problems. Prereq: senior standing. 3 cr.

695 A-D—696 A-D. MECHANICAL ENGINEERING UNDERGRADUATE PROJECTS AND INDEPENDENT STUDY
Course numbers refer to topics in A) Thermal Science; B) Solid Mechanics; C) Engineering Design; and D) Materials. An instructor may assign an "IA" grade (continuing course) at the end of one semester. 1-4 cr.

697, 698. MECHANICAL ENGINEERING SEMINAR
Study and discussion of engineering topics; student-faculty participation. 1 cr.

701. MACROSCOPIC THERMODYNAMICS
Thermodynamic principles using an analytic, postulational approach and Legendre transformations to obtain thermodynamic potentials. 4 cr.

702. STATISTICAL THERMODYNAMICS
Macroscopic thermodynamic principles developed by means of microscopic analysis. Prereq: M E 503. 4 cr.

703. HEAT TRANSFER
Analysis of phenomena; steady-state and transient conduction, radiation, and convection; engineering applications. Co- or prereq: M E 508. 3 cr.

707. ANALYTICAL FLUID DYNAMICS
Development of the Navier-Stokes equations; vorticity theorems; turbulence and boundary-layer theory. Prereq: M E 508. 4 cr.

708. GAS DYNAMICS
Basic equations of motion of one-dimensional, subsonic, and supersonic flows of compressible, ideal fluids. Wave phenomena. Rankine-Hugoniot relations. Linear approach to two-dimensional flow problems. Prereq: M E 508. 4 cr.

710. SOLAR HEATING SYSTEMS
Analysis and computer modeling of solar radiation as an energy source for heating. Phenomena, availability, collection, performance, and economy of solar energy for heating systems. Prereq: M E 703. 3 cr.

717. CRYOGENICS
Phenomena and processes at very low temperatures. Basic engineering sciences applied to problems of low temperature refrigeration, liquefaction, separation, and storage; transport of cryogenic fluids; measurement systems; vacuum technology. Prereq: M E 503. 4 cr.

723. ADVANCED DYNAMICS
Classical dynamics oriented to contemporary engineering applications. Review of particle dynamics. Hamilton's principle and the Lagrange equations. Kinematics and dynamics of rigid bodies, gyroscopic effects in machinery and space structures. 4 cr.

724. VIBRATION THEORY AND APPLICATIONS
Discrete vibrating systems. Linear system concepts; single-degree-of-freedom system with general excitation. Matrix theory and eigenvalue problems. Many degrees of freedom, normal mode theory for free and forced vibration. Numerical methods; introduction to continuous systems; applications to structural and mechanical systems. Prereq: M E 628. 4 cr.

726. EXPERIMENTAL MECHANICS
Experimental methods and theoretical bases applied to measurement of stress, strain, and motion. Transmitted and scattered-light photoelasticity; strain gage applications; brittle coating and grid techniques; dynamic measurements, and associated instrumentation. 4 cr.

727. ADVANCED MECHANICS OF SOLIDS
Beams on elastic foundation, curved bars, inelastic behavior, instability, introduction to thin plates and shells, introduction to elasticity, energy methods, and numerical methods. 4 cr.

730. MECHANICAL BEHAVIOR OF MATERIALS
Elastic and inelastic behavior of materials in terms of micro- and macromechanics. Stress, strain, and constitutive relations related to recent developments in dislocation theory and other phenomena on the atomic scale and to the continuum mechanics on the macroscopic scale. Elasticity, plasticity, viscoelasticity, creep, fracture, and damping. Anisotropic and heterogeneous materials. 4 cr.

737. OCEAN MECHANICS I
Ocean as a continuous medium, its mechanical and thermodynamic properties. Shallow- and deep-ocean modeling for the investigation of gravity and sound waves. Ocean subbottom and its soil mechanical and sound propagation properties. Instrumentation, rudimentary data collecting and processing procedures, and computer usage. Prereq: M E 508; 525; 526; 527; Math 527; 528. 4 cr.

738. OCEAN MECHANICS II
Ocean dynamical laws generalized to include temperature and salinity variations in the water column. Conservation laws with generalized equation of state. Air-sea interaction, energy transport phenomena, reflection from different coastal geometry, harbor resonances, internal currents. Sound reflection from subbottom, sound probing techniques to determine subbottom properties by ray theory and generalization of subbottom soil from an elastic to a viscoelastic medium. Prereq: M E 737; M E 781 desirable but not required. 4 cr.

741. FLUID CONTROL SYSTEMS
Mathematical modeling of hydraulic, pneumatic, and fluidic control elements and control systems. Methods for: 1) analysis of systems using gases or liquids as the working fluid; 2) synthesis of the parameters of the control elements used in fluid control systems; 3) design of these systems. (Also offered as E E 741.) 4 cr.

751. NAVAL ARCHITECTURE IN OCEAN ENGINEERING
Selected topics in the fundamentals of naval architecture pertinent to ocean engineering, including hydrostatic characteristics, basics of resistance and propulsion and rules and regulations for surface, semisubmersible, and submersible marine vehicles. Computer applications. Prereq: M E 508; M E 525; /or permission. 4 cr.

752. SUBMERSIBLE VEHICLE SYSTEMS DESIGN
Conceptual and preliminary design of submersible vehicle systems; submersibles, environmental factors, hydromechanic and structural principles, materials, intra/extravehicle systems, operating considerations. predesign and design procedures. Design projects selected and completed by student teams. Prereq: permission. 4 cr.

757. COASTAL ENGINEERING AND PROCESSES
Introduction to small amplitude and finite amplitude wave theories. Wave forecasting by significant wave method and wave spectrum method. Coastal processes and shoreline protection. Wave forces and wave structure interaction. Introduction to mathematical and physical modeling. Prereq: M E 508 or permission. 3 cr.

760. PHYSICAL METALLURGY I
Introduction to the electron theory of metals, intermetallic compounds, ferro magnetism, dislocations, and slip phenomena. 4 cr.

761. X-RAY DIFFRACTION
Physics of X-ray diffraction, the reciprocal lattice, lattice parameter determinations, space group identification, phase identification, characterization of preferred orientation. Lab. 4 cr.

763. MICROSTRUCTURE OF SOLIDS
Basic concepts and measurements; statistically exact expressions for points, lines, surfaces, and volumes; random, partially oriented and oriented structures; particle and grain characteristics and distributions; projected images and shape specification; practical applications. 4 cr.

766. PHYSICAL CERAMICS
Characteristics of crystalline and noncrystalline ceramic solids; defect structures; diffusion in ceramic materials; nucleation and crystal growth, spinodal decomposition, and solid-state reactions; kinetics of grain growth; sintering, and vitrification. Prereq: permission. 4 cr.

771. DYNAMIC SYSTEMS MODELING
Lumped parameter models for mechanical, electrical, fluid, thermal, and mixed systems. Time-domain solutions, frequency-response plots, matrix representations, eigenvectors, and eigenvalues are used to explore system response. Introduction to nonlinear analysis, simulation, computer applications. Prereq: ME 648 or permission. 3 cr.

781. MATHEMATICAL METHODS IN ENGINEERING SCIENCE I
Solution of discrete and continuous systems. Review of calculus, linear algebra, complex numbers, Fourier series, differential and partial differential equations with examples from acoustics, vibration theory, hydrodynamics, elasticity, solid mechanics, transport theory, and particle mechanics. 4 cr.

782. CONTROL SYSTEMS
Fundamental principles involved in the design and analysis of feedback control systems. Topics include stability criterion, time-domain analysis, frequency-domain analysis, and introduction to nonlinear systems. Lab. (Also offered as E E 782.) Prereq: permission. 4 cr.

793 A-D–794 A-D. SPECIAL TOPICS IN ENGINEERING
Course numbers refer to topics in A) Thermodynamics; B) Solid Mechanics; C) Engineering Design; and D) Materials. Content of these topics may vary from year to year. 2-4 cr.

795 A-D–796 A-D. INDEPENDENT STUDY
Course numbers refer to topics in A) Thermal Science; B) Solid Mechanics; C) Engineering Design; and D) Materials. 2-4 cr.

Medical Technology (MedT)

(For program description, see page 68)

CHAIRPERSON: Karol A. LaCroix
ASSOCIATE PROFESSOR: Karol A. LaCroix
ASSISTANT PROFESSORS: Sylvia Countway, Martha Hopkins
ADJUNCT ASSOCIATE PROFESSORS: Trulls Brinck-Johnsen; E. Elizabeth French, M.D.
ADJUNCT ASSISTANT PROFESSORS: Robert Beck, M.D.; Denis J. Carlson, M.D.
ADJUNCT CLINICAL INSTRUCTOR: Elizabeth A. Ward
ADJUNCT LECTURERS: James Dennett, Joyce R. Gallagher, Mary Ellen Kottmeyer, Kerry Ryan, Ernst Schori

401. INTRODUCTION TO MEDICAL TECHNOLOGY
Functions and responsibilities of medical technology as a unit of the health team. Lectures, films, demonstrations, and field trips. Prereq: second-semester freshman or sophomore major standing. 0 cr.

600. PATHOLOGY
Lectures on recent advances in the field of clinical laboratory technology, disease diagnosis, and disease management, with an emphasis on case studies. 2 cr.

602. MEDICAL LABORATORY SEMINARS
Clinical case study presentations emphasizing the role of the laboratory in diagnosing and treating disease. Senior MedT majors only or by permission. 1 cr. Cr/F.

625. CLINICAL LABORATORY METHODS I
Identification and analysis of components of cellular elements of peripheral blood; hemostasis; their relationship to the body in health and disease. Introductory methods in immunohematology. Prereq: Zool 507-508 or permission. Lab. 4 cr.

626. CLINICAL LAB METHODS II
Clinical significance, performance, and evaluation of basic manual procedures for urine and plasma. Includes macro- and microscopic analysis of urine, plasma glucose, BUN, creatinine, electrolytes, enzymes, cholesterols, bilirubins, and uric acid determinations. Prereq: Chem 403-404. Lab. 4 cr.

651. CLINICAL MICROBIOLOGY
Routine methodologies in clinical microbiology. Culture planting techniques, bacterial identifications, antibiotic sensitivity testing. Junior MedT majors only. 4 cr.

652. CLINICAL HEMATOLOGY
Routine hematological procedures, both manual and automated. Analysis of white blood cells, red blood cells, and platelets; hemostasis techniques. Junior MedT majors only. 4 cr.

653. CLINICAL IMMUNOHEMATOLOGY
Routine blood banking procedures, including blood typing, antibody screening, cross-matching, and confirmatory testing on blood units. Junior MedT majors only. 4 cr.

654. CLINICAL CHEMISTRY
Practice in the operation of automated and manual chemistry systems. Theory and laboratory analysis of routine blood chemistry components. Routine examination of the urine. Junior MedT majors only. 4 cr.

696. INDEPENDENT STUDY
In-depth studies under faculty supervision. Staff. Prereq: junior standing; approval of the major adviser and the faculty of the area concerned. 2-4 cr.

720. CLINICAL MYCOLOGY-PARASITOLOGY
Clinical laboratory identification and pathology of human mycology and parasitology infections. Classification and diagnosis of clinically significant viruses. Prereq: Micr 702. Lab. 4 cr.

751. DIAGNOSTIC MICROBIOLOGY
Advanced clinical bacteriological procedures, fluorescent techniques, and special procedures. Mycology and parasitology identification and testing. Senior MedT majors only. 4 cr.

752. ADVANCED HEMATOLOGY
Special hematology procedures including diagnostic staining, advanced hemostasis studies, and evaluation of blood cells in disease states. Senior MedT majors only. 4 cr.

753. ADVANCED IMMUNOHEMATOLOGY
Advanced blood banking procedures, including antibody identification, and component therapy. Principles and procedures for detecting disorders of cellular and humoral immunity. Senior MedT majors only. 4 cr.

754. ADVANCED CLINICAL CHEMISTRY
Theory, operation, evaluation, and maintenance of automated chemistry systems. Advanced laboratory analysis of body fluid chemistries including enzymology, isotopes, hormones, blood gases, and toxicology. Data analysis, computerization. Senior MedT majors only. 4 cr.

Microbiology (Micr)

(For program description, see page 30)

CHAIRPERSON: Robert M. Zsigray
PROFESSORS: William R. Chesbro, Galen E. Jones
ASSOCIATE PROFESSORS: Richard P. Blakemore, Thomas G. Pistole, Robert M. Zsigray
ASSISTANT PROFESSOR: Florence E. Farber

501. PUBLIC HEALTH MICROBIOLOGY
Medical microbiology with emphasis on immunology, pathogenic bacteriology, parasitology, animal virology, and the incidence and control of human communicable diseases. Lab (502) optional. 3 cr.

502. PUBLIC HEALTH MICROBIOLOGY LABORATORY
Laboratory techniques for identification of important pathogenic microorganisms and disease diagnosis. (Students must register for Micr 501 concurrently.) 1 cr.

503. GENERAL MICROBIOLOGY
Principles of microbiology; morphology, physiology, genetics, culture and classification of bacteria and other microorganisms, and their relationships to agriculture, industry, sanitation, and infectious diseases. Prereq: Chem 401-402 or equivalent. Lab. 5 cr.

600. ENVIRONMENTAL MICROBIOLOGY
Detection, identification, and regulation of microorganisms which enhance or deteriorate the immediate human environment. Prereq: Micr 503. Lab. 4 cr.

701. TAXONOMY AND ECOLOGY
Isolation, identification, and classification of prokaryotic microorganisms by classical and newer techniques; analysis of the interplay between organism and environment; uses of taxonomic and ecological information. Prereq: Micr 503; Bchm 601 or 656. Lab. 4 cr.

702. PATHOGENIC MICROBIOLOGY
Morphological, cultural, biochemical, serological, and pathogenic characteristics of microorganisms causing human and animal diseases. Prereq: Micr 503. Lab. 4 cr.

704. MICROBIAL GENETICS
Expression and transfer of genetic elements (chromosomal and nonchromosomal) in prokaryotic and eukaryotic microorganisms; consideration of factors influencing public health, industry, the environment, and society. Prereq: Micr 503; Bchm 601 or 656. Lab. 4 cr.

705. IMMUNOLOGY AND SEROLOGY
Examination of the immune response in vertebrates. Characterization of the major components of the immune system; study of host-defense mechanisms and immunopathology; use of serological techniques for identification and diagnosis. Prereq: Micr 702; permission. Lab. 4 cr.

706. VIROLOGY
Principles of animal, and in selected instances, plant and bacterial virology in relation to infection and disease. Emphasis on the molecular biology of viruses, viral replication, isolation, propagation, assay, pathogenesis, diagnosis, epidemiology, and control. Virus-host interactions, especially the role of viruses in malignant transformation. Prereq: Micr 702; permission. Lab. 4 cr.

707. MARINE MICROBIOLOGY
Characterization of microorganisms in the sea including taxonomy, physiology, and ecology; sampling, enumeration, distribution; and effects of marine environment upon microbial populations. Prereq: Micr 503 and organic chemistry. Lab. 4 cr.

708. MICROBIAL BIOGEOCHEMISTRY
Geochemical processes influenced by biochemical processes catalyzed by marine and terrestrial microorganisms; transformations of carbon, nitrogen, and other elements. Petroleum microbiology, nat-

ural gas production, sulfur formation, manganese nodules, corrosion, and fossil microorganisms. Prereq: Micr 503 and organic chemistry. Lab. 4 cr.

710. MICROBIAL CYTOLOGY AND ULTRASTRUCTURE
Ultrastructure and function in prokaryotic cells; discussion of flagella, pili, walls, membranes, cytoplasmic inclusions, cell division, sporulation, and germination. Cytological features of structurally unique bacteria. Prereq: Micr 503. 3 cr.

711. TRANSMISSION ELECTRON MICROSCOPY
Electron microscope techniques for the study of microbial cytology: theory and use of the transmission electron microscope; sample preparation methods, photomicrography, and photographic darkroom techniques; interpretation of electron micrographs. Prereq: Micr 503; Micr 710; permission. Lab. 4 cr.

712. SOIL MICROBIOLOGY
Microbial ecology of the soil environment; characteristics of major microbial groups in soil; factors affecting activity of soil microorganisms; their effects on the environment; and biological interactions which involve them. Prereq: Micr 503. Lab. 4 cr.

793. PROBLEMS IN MICROBIAL CYTOLOGY
A) Research with Electron Microscopy; B) Teaching Practices in Electron Microscopy. Students may select sections for advanced study. May include reading, lab work, organized seminars, and conferences. Other sections may be offered in some semesters; see Micr office for semester offerings. Prereq: permission. 1-4 cr.

795, 796. PROBLEMS IN MICROBIOLOGY
Prereq: permission. 1-8 cr.

Military Science (Milt), Reserve Officers Training Corps

(For program description, see page 82)

PROFESSOR OF MILITARY SCIENCE: Lt. Col. Michael H. Everngam
ASSISTANT PROFESSORS: Maj. Richard G. Dubuque, Capt. Leroy A. Herbel, Capt. Richard G. Kamakaris, Capt. Stephen J. Morin

413. THE DEFENSE ESTABLISHMENT AND NATIONAL SECURITY I
The Army as an element of the U.S. defense establishment and its role in national security. The ROTC program; tactical maneuver elements; combat, combat support, and combat service support branches; key internal and external relationships; current world events of significance to the Army officer. Lab (required only of cadets). 1 cr.

414. THE DEFENSE ESTABLISHMENT AND NATIONAL SECURITY II
Elements of the U.S. defense establishment and their role in national security. Major Army commands; separate operating agencies; other uniformed services; civilian agencies; interrelationships; the principle of civilian control of the military; current world events of significance to the Army officer. Lab (required only of cadets). 1 cr.

501. BASIC MILITARY SKILLS
Basic drill and ceremonies; customs and courtesies of the Army; map reading. 1 cr.

525. AMERICAN MILITARY HISTORY
Development of American military institutions, civil-military relations, and the use of violence as an instrument of foreign policy from the colonial period to the present; battle/campaign analysis; the Army in New Hampshire. 4 cr.

632. MILITARY LEADERSHIP AND MANAGEMENT
Human relations, interpersonal communications, and group interaction. Authoritarian vs. participative leadership and management, motivation and self-actualization. Theory of teaching methods. Examination of leadership models. Lab (required only of cadets). 4 cr.

641. SEMINAR ON LEADERSHIP AND MANAGEMENT
Military team concept, and the coordination and planning necessary between elements of the team; analysis of contemporary problems; discussion of military justice system. 4 cr.

695. OFFICER INTERNSHIP
Experiential learning through field work in a military-type unit. Written analysis required. Prereq: Milt 632; Milt 641 (may be taken concurrently). By permission only. May be taken up to a total of 8 credits. 1-4 cr.

Music

(For program description, see page 31)

CHAIRPERSON: Cleveland L. Howard
PROFESSORS: Keith Polk, John D. Wicks
ASSOCIATE PROFESSORS: Ruth S. Edwards, Stanley D. Hettinger, Cleveland L. Howard, Mary H. Rasmussen, John E. Rogers, David E. Seiler, W. Niel Sir, Paul F. Verrette, Henry J. Wing, Jr.
ASSISTANT PROFESSORS: Audrey Adams Havsky, Leslie J. Hunt, Christopher Kies, Roy Mann, Robert Stibler, Peggy A. Vagts, Larry J. Veal
FACULTY IN RESIDENCE: Nicholas M. Orovich

History, Literature, and Appreciation (Musi)

401. INTRODUCTION TO MUSIC
Fundamental approach to perceptive listening, based on a detailed study of several masterpieces representing different periods and forms. Historical perspective, but main emphasis is on confronting significant works of musical art on their own terms. Some participation in musical life of the University required. Does not fulfill a major requirement. 4 cr.

402. SURVEY OF MUSIC HISTORY
Historical development of musical style in relation to the whole fabric of Western civilization. Prereq: Musi 401. Not open to music majors. 4 cr.

501-502. HISTORY AND LITERATURE OF MUSIC
Styles, forms, and techniques of composition in Western music. Required of all music majors. 4 cr.

511. SURVEY OF MUSIC IN AMERICA
From colonial times to the present, including the various European influences, the quest for an American style, and the emergence of such indigenous phenomena as jazz. 4 cr.

513. INTRODUCTION TO THE MUSIC OF AFRICA AND ASIA
Folk and classical music of various ethnic cultures, particularly those of Japan, India, and sub-Saharan Africa. 4 cr.

581. HARMONY IN TRADITIONAL JAZZ AND POPULAR MUSIC
A practical course in the harmonization of popular songs and "blues." Typical chord progressions; their logic, extensions, and symbolic representations. Written exercises and instrumental improvization. Prereq: knowledge of notation and fundamental harmony; ability to perform on a musical instrument. Some keyboard skill highly desirable. Permission. 4 cr.

595. SPECIAL TOPICS IN MUSIC LITERATURE
Open to music majors and nonmajors; topics in areas not easily covered in historical courses. May be repeated for credit. Prereq: permission. 1-4 cr.

701. MUSIC OF THE MEDIEVAL PERIOD
Nature of the beginnings of polyphony. The preeminent influence of the church in the 13th century and the rising secular movement in the 14th. Music as a dominant force in the political and social life of the Middle Ages. 4 cr.

703. MUSIC OF THE RENAISSANCE
Works of the 15th- and 16th-century composers from Dunstable to Palestrina. 4 cr.

705. MUSIC OF THE BAROQUE
Music of Europe from de Rore to Bach. 4 cr.

707. MUSIC OF THE CLASSICAL PERIOD
Growth of musical styles and forms from early classicism through the high classicism of Haydn, Mozart, and the young Beethoven. 4 cr.

709. MUSIC OF THE ROMANTIC PERIOD
A survey of romanticism in music from Beethoven's late period to the end of the 19th century. The works of Schubert, Berlioz, Schumann, Mendelssohn, Chopin, Wagner, Verdi, Brahms, Austrian symphonists, French pre-impressionists, and national styles in European music. 4 cr.

711. MUSIC OF THE 20TH CENTURY
Styles and techniques of composers from Debussy to the present. Special emphasis on tonal music before World War I; neoclassical trends; the emergence of atonality and serial techniques; antirationalist music; electronic music. 4 cr.

721. THE LIFE AND WORKS OF BEETHOVEN
Detailed study of Beethoven, his times, and his art as exemplified by his symphonies, piano music, chamber music, sacred music, and works for the stage. 4 cr.

732. THE ART SONG
History and literature of the solo song with piano accompaniment. Survey of national styles of the 19th and 20th centuries and deeper study of the central core of the art song—the German Lied. 4 cr.

733. SURVEY OF OPERA
History of the genre from Monteverdi to the present. Representative masterpieces by Handel, Mozart, Beethoven, Weber, Wagner, Verdi, Mussorgsky, Debussy, Berg, and others. 4 cr.

735. SURVEY OF PIANOFORTE LITERATURE
Keyboard literature from the Baroque to the present. Analysis, discussion, and illustration of works by Bach, Haydn, Mozart, Beethoven, the romantic composers, and contemporary writers. 4 cr.

795. SPECIAL STUDIES IN MUSIC
A) J.S. Bach; B) Franz Schubert; C) Debussy and Ravel; D) The World of Jazz; E) The Iconography of Western-European Musical Instruments; F) 19th-Century French Music; G) Advanced Analysis; H) Advanced Study in Electronic Music; I) Composition through Computer-generated Sound; J) Woodwind Literature; K) Brass Literature; L) String Literature; M) Medieval Performance Practice; N) Renaissance Performance Practice; O) Baroque Performance Practice; P) Classical Performance Practice; Q) 19th-Century Performance Practice; R) 20th-Century Performance Practice; S) Woodwind Repair; T) String Repair; U) Advanced Jazz Improvisation; V) Advanced Piano Pedagogy; W) Advanced Accompanying; X) Advanced Conducting; Y) Independent Study. Prereq: permission. May be repeated for credit with permission. 1-4 cr.

Performance (Musi)

Registration for musical organization courses should be completed during the registration period. All music laboratory courses may be repeated. A maximum of 8 credits earned in music laboratory may be used toward graduation.

Private lessons are based on a half hour of individual instruction per week. One semester-hour credit may be earned with one lesson per week; two or four semester hours of credit may be earned with two lessons per week (only students in the Bachelor of Music curriculum are allowed to register for four credits). Five one-hour practice periods are expected for each credit of private study. The special semester fee for lessons is $35 per half-hour lesson (this fee applies for courses numbered 541 through 550). The fee includes the use of a practice room for the required preparation.

Registration in courses of private instruction is open to all students in the University, subject to approval by the Department of Music and the instructor. Enrollment is limited in these courses. Students may register for credit in successive semesters.

441. CONCERT CHOIR—TECHNIQUES AND LITERATURE
Study and performance of classical and modern choral literature. Recommended for voice majors. Open to all students. Prereq: permission. 1 cr.

442. CHAMBER CHORUS
A mixed chorus which studies and performs sacred and secular works from the Renaissance to the present, participates with the opera workshop and with the orchestra, and serves as a nucleus for larger choral-instrumental work. Prereq: permission. 1 cr.

443. WOMEN'S CHORUS
Open to all students interested in singing the finest literature in this medium and who can fulfill the requirement of an audition. 1 cr.

444. THE NEWHAMPSHIREMEN
The male chorus of the University. Recommended for all male voice majors. Prereq: permission and audition. 1 cr. Cr/F.

445. SUMMER SESSION CHORUS AND BASIC CONDUCTING
Study and performance of the best classical and modern choral literature. Basic elements of choral conducting for elementary and secondary teachers, church choir directors, and those interested in singing. May be repeated. 1 cr.

448. OPERA WORKSHOP
Operatic singing, acting, and production techniques; performance of both complete operas and operatic excerpts. Prereq: permission. 1 cr.

450. SYMPHONY—TECHNIQUES AND LITERATURE
Presents several concerts during the year, of repertoire ranging from the great, standard symphonic literature to experimental, multi-media composition. Prereq: permission of conductor and audition. 1 cr.

451. UNH TRAINING ORCHESTRA
Designed for music education majors but open to all who wish to develop proficiency on major or secondary instruments. Ensemble experience in the basic repertoire often met in school situations for students who do not yet meet the standards required for the UNH Symphony. 1 cr.

452. UNH SYMPHONIC WIND ENSEMBLE
Open to all students. Campus concerts and New England tour. Prereq: permission and audition. 1 cr.

453. UNIVERSITY BAND
Original band music, transcription, marches, etc. For students whose program does not permit music as a major interest, but who are interesred in maintaining their playing proficiency and continuing their study of music. Prereq: permission 1 cr.

454. UNH MARCHING BAND
Open to all students; performs during home and away football games. Rehearsals conclude at the end of the football season. Prereq: permission. 1 cr. Cr/F.

455. PIANO ENSEMBLE—TECHNIQUES AND LITERATURE
Drawing from available student instrumentalists and singers, pianists learn the art of performing in trios, duo sonatas, and two-piano works, and gain experience in Lieder accompaniment. 1 cr.

456. STRING ENSEMBLE—TECHNIQUES AND LITERATURE

457. WOODWIND ENSEMBLE—TECHNIQUES AND LITERATURE

458. BRASS ENSEMBLE—TECHNIQUES AND LITERATURE

459. PERCUSSION ENSEMBLE—TECHNIQUES AND LITERATURE

460. JAZZ ENSEMBLE—TECHNIQUES AND LITERATURE

In these five courses, groups of instrumentalists gain experience in the performance of literature for the smaller ensemble. Prereq: permission. 1 cr.

461. VOCAL ENSEMBLE
Singers perform in small ensembles such as trios, quartets, quintets, and octets. Prereq: permission. 1 cr.

467. FUNCTIONAL PIANO
Basic instruction for music majors with no previous keyboard training. Pianoforte technique, keyboard harmony geared to the practical harmonization of simple melodies, sightreading, transposition, and modulation. May involve both class instruction and periodic short individual lessons. Prereq: permission. 1 cr.

541. VOICE

542. PIANO

543. HARPSICHORD

544. ORGAN

545. VIOLIN, VIOLA

546. VIOLONCELLO, STRING BASS

547. WOODWIND

548. BRASS

549. PERCUSSION

550. HARP (Offered by special arrangement with the department.)

551. EARLY WIND INSTRUMENTS
In courses 541 through 551 (private instruction in performance) presentation and material used vary with pupil. Emphasis on musical values and sound technique. As the student advances, repertory is broadened to include works of all periods. One solo performance each semester may be required. Prereq: permission. 1 or 2 lessons; 1, 2, or 4 cr.

751-752. CONDUCTING METHODS
Physical aspects, equipment of conductor, fundamental gestures and beats, baton techniques. Reading and analysis of full and condensed scores, study of transposition, psychology of rehearsal. Prereq: Musi 571-572 and junior standing. 2 cr.

754. COLLEGIUM MUSICUM
Instrumentalists and singers perform small ensemble music from all periods, with emphasis on Renaissance and Baroque music. Prereq: permission. 1 cr.

Theory and Composition (Musi)

411-412. FUNDAMENTALS OF MUSIC THEORY
Elements of music theory for the non-music major; principles of musical structure, analysis, elementary written counterpoint and harmony, and ear training. May not be counted for credit toward a music major. Prereq: Ability to read music and permission of instructor. 4 cr.

471-472. THEORY I
Introduction to the tonal system; principles of voice leading and harmonic progression through the analysis, realization, and composition of one-, two-, and four-voiced textures. Concept of triad inversion and consonant diatonic harmonies of the major and minor modes. Students should register for 473-474 concurrently. Prereq: permission. 3 cr.

473-474. EAR TRAINING I
Laboratory exercises to develop aural skills; sight-singing and dictation. Students should register for Musi 471-472 concurrently. Prereq: permission. 1 cr.

571-572. THEORY II
Continuation of Musi 471-472. Compositional and analytic work stresses the treatment of dissonance within the tonal system; accessory tones, seventh chords, tonicization, modulation, basic principles of chromatic harmony, and harmonization of chorale melodies are covered. Students should register for 573-574 concurrently. Prereq: Musi 472; Musi 474; permission. 3 cr.

573-574. EAR TRAINING II
Laboratory exercises to develop aural skills further. Students should register for Musi 571-572 concurrently. Prereq: Musi 472, 474; permission. 1 cr.

771-772. COUNTERPOINT
Contrapuntal techniques of tonal music. Melodic construction and dissonance treatment through work in species counterpoint and studies in harmonic elaboration and prolongation. Analysis of selected compositions emphasizes the connection between fundamental countrapuntal techniques and the voice-leading of composition. Prereq: Musi 572 or permission. 2 cr.

773. ADVANCED COUNTERPOINT
Continuation of Musi 772. Prereq: Musi 772 or permission. 2 cr.

775-776. COMPOSITION
Construction of phrases, periods, and short compositions following classical models. Problems of text-setting. Prereq: Musi 572 or permission. 3 cr.

777. ADVANCED COMPOSITION
Continuation of Musi 776. Individual compositional projects. Prereq: Musi 776 and permission. May be repeated for credit. 3 cr.

779. ORCHESTRATION
Characteristics of band and orchestral instruments both individually and in small (homogeneous) and large (mixed) groupings. Students study scores, write arrangements, and have arrangements performed if at all possible. Some aspects of vocal writing. Prereq: Musi 572 or permission. 4 cr.

781. FORM AND ANALYSIS
Formal and textural elements; concepts and examples. Thorough analysis of smaller and larger masterworks from the standpoint of harmony, counterpoint, structural line, and formal articulation. Prereq: Musi 572 or permission. 4 cr.

785. ELECTRONIC SOUND SYNTHESIS
Part I: "traditional" or "analog" electronic sound synthesis; work with the Buchia Synthesizer in the elecronic music studio. Part II: 1) elementary programming in FORTRAN, 2) the logic of computer sound syntheses, and 3) programming in MUSIC 4BF. Students will have the opportunity to run programs on a DEC KL10 computer equipped with 4-channel digital-to-analog and analog-to-digital converters. Part III: completion of a major independent study project in electronic music. Prereq: permission. 4 cr.

Music Education (MuEd)

500. EXPLORING MUSIC TEACHING
Introductory fieldwork course for students to explore music teaching as a career. Observation, teaching, research, examination of multi-mechanical aids for music curriculum development. Coreq: Educ 500. 2 cr. Cr/F.

540. BEGINNING TECHNIQUES IN VOICE
Basic techniques of voice production. Individual work is emphasized. Working knowledge of an instrument required. This course is desirable for, but not restricted to, MuEd majors. Prereq: permission. 2 cr.

545, 546. BEGINNING TECHNIQUES IN STRING INSTRUMENTS
Class and individual instruction. Four hours practice per week. Training on the violin, viola, and cello. Classroom procedures, establishment of string programs, and evaluation of available methods materials. 2 cr.

595. SPECIAL PROJECTS IN MUSIC EDUCATION
Individual investigation, research, or study. Creative projects may be included. Prereq: permission. 1-4 cr.

741-742. TECHNIQUES AND METHODS IN CHORAL MUSIC
Problems in the organization and performance of high school, college, and community choruses. Techniques of choral conducting and rehearsal, repertory, and materials. 2 cr.

743. MATERIALS AND METHODS IN PIANO MUSIC
Gives potential piano teachers a coherent but flexible approach to the instruction of students of different ages and levels of talent through evaluation of methods and materials and discussion of the role of the private teacher. 2 cr.

745-746. TECHNIQUES AND METHODS IN STRING INSTRUMENTS
Class and individual instruction. Four hours of practice per week required. Intensive training on the violin, viola, cello, and double bass enables participants to perform in string ensembles. Classroom procedures, establishment of string pro-

grams, and evaluation of available methods materials. 2 cr.

747-748. TECHNIQUES AND METHODS IN WOODWIND INSTRUMENTS
Basic fundamentals of performance, class instruction, associated acoustical problems and study of woodwind literature. First semester: clarinet, flute, and saxophone. Second semester: double-reed instruments. 2 cr.

749. TECHNIQUES AND METHODS IN BRASS INSTRUMENTS
Basic course in embouchure formation, tone, tonguing, fingering, flexibility, accuracy, and range development as applied to the trumpet or baritone horn, French horn, and trombone; methods, studies, solos, and ensembles most likely to be useful with grade school, junior high school, and high school players of brass instruments. 2 cr.

751. TECHNIQUES AND METHODS IN PERCUSSION INSTRUMENTS
Basic performance skills on snare drum, timpani, mallet instruments, and other percussion instruments used in bands and orchestras. Materials and methods of instruction. 2 cr.

785. MUSIC FOR THE ELEMENTARY CLASSROOM TEACHER
Designed for the nonspecialist. Correlation and integration of music in the school curriculum, and basic skills and techniques necessary. 4 cr.

787-788. THE TEACHING OF ELEMENTARY AND MIDDLE SCHOOL MUSIC
Aims, scope, and organization of materials and activities in elementary and middle schools. Modern trends in educational philosophy; development of the child's voice; demonstration of materials and methods for the various grades. Observation and teaching in schools. 2 cr.

791-792. THE TEACHING OF SECONDARY SCHOOL MUSIC
Educational principles applied to music teaching and learning; curriculum organization for junior and senior high school. Adolescent voice, voice classification, selection of vocal and instrumental materials, and building unified concert programs. Problems of administration; management; relationship of the teacher to school and community. Observation of secondary school music programs. 2 cr.

795. SPECIAL STUDIES IN MUSIC EDUCATION
Allows upper-level students to explore individually or in groups areas related to their specific professional interests. Prereq: permission. 1-4 cr.

796. ORGANIZATION AND ADMINISTRATION OF SCHOOL MUSIC GROUPS
Problems of organizing and administering school orchestras, bands, glee clubs, choruses, and small ensembles; objectives, motivation, schedule, discipline, equipment, programs, finances, rehearsal techniques, contests and festivals, materials, personnel selection, and grades. 4 cr.

Nursing (Nurs)

(For program description, see page 69)

CHAIRPERSON: Juliette Petillo
ASSOCIATE PROFESSORS: Marguerite Fogg, Ann Kelley, Juliette Petillo, Rosemary Wang
ASSISTANT PROFESSORS: Claire Dunbar, Gwenyth Gerhard, Dona Lethbridge, Diane McCann, Doris Noyes, June Roberts, Raelene Shippee-Rice, Margaret Spears, Joan Tomasi, Carol Williams
INSTRUCTORS: Angela Barclay, Susan Crowell, Linda Cutler, Kathryn Lynch, Judith Lyons, Carol Sharkey
LECTURERS: Karen Leatherbee, Susan Walker

404. SUICIDOLOGY
Introductory course in the study of self-destructive behaviors and suicide: epidemiologic and demographic variables, theories of death and dying, related research. Emphasis on prevention, assessment, intervention, and postvention in suicide risk. Open to all students. 4 cr.

505. NURSING—A DEVELOPING PROFESSION
The impact of historical developments upon the present status of nursing as a profession; future of nursing as a developing profession. Through selected clinical and laboratory activities the student begins to identify with nursing as a profession. Prereq: Zool 507-508; Psyc 401; Soc 400; Engl 401; sophomore major. 2 cr.

506B. SEMINAR ON PROFESSIONAL NURSING
Health and how interactions between physical and social environments affect it. Nature and function of health care systems and role of health professionals from historical, social, political, economic, and technical viewpoints. Individual student examination of values, attitudes, and beliefs regarding professional role and personal goals, in relation to current nursing practice. Open to EBORN students only. 6 cr.

510. FOUNDATIONS OF NURSING PRACTICE
Basic course in professional nursing. The nursing process; interrelationships of the individual, nursing, health, and environment. Through selected laboratory and clinical experiences the student begins to develop skills necessary for nursing practice. Prereq: Nurs 505; major. 4 cr.

530. THE DYNAMICS OF ADDICTION
Dynamics of addiction from the viewpoint of a disease process. Reasons for treatments and implications of addiction to drugs, alcohol, and other bodily stimuli. Cause and effect relationships involved in addiction examined from the perspectives of the individual and society. Role implications for health care providers in relation to prevention and treatment. Open to all students, sophomore and above. 4 cr.

535. DEATH AND DYING
The physical, behavioral, and emotional significance of death and dying for the individual and family. Focus on self-awareness, dynamics and patterns of interaction, and the role of the helping person. Open to all students. Prereq: permission. 4 cr.

550. NURSING MANAGEMENT
Provides a base for understanding the concepts, principles, and skills needed to function as a nurse manager. Content includes the following functions of nursing management: planning, organizing, staffing, influencing, and controlling. 4 cr.

595. WOMEN'S HEALTH
The course will examine women's health and women's health care from historical, political, and social perspectives. It will include discussion of societal and health care constraints which hinder women from achieving their full health potential. The course also presents information on women's health care practices, including the concept of self-care, and relates this to the development of educated consumerism in the health care system. 4 cr.

601. NURSING I
Concepts essential to the practice of nursing and awareness of the biopsychosocial needs of the individual. These concepts provide a foundation for interpreting responses to stress and the adaptive mechanisms utilized to restore wellness. Prereq: junior major. 4 cr.

601C. NURSING OF ADULTS
Assessment of nursing care needs in selected adult clients. In clinical practice the student intervenes to help the individual meet basic biopsychosocial needs. Prereq: junior major. 4 cr.

601D. NURSING OF CHILDREN
Major health problems of children and current trends in meeting the psychosocial and physical needs of the ill child. In clinical practice the student intervenes to meet the needs of the ill child and the family. Prereq: junior major. 4 cr.

601E. NURSING OF THE CHILDBEARING FAMILY
The concept of family-centered care during childbearing. In clinical practice the student identifies needs and helps families adapt and function during this period. Prereq: junior major. 4 cr.

610. NURSING II
Biopsychosocial dysfunction and its influence on the individual's ability to maintain an optimal level of functioning; implications for nursing practice. Prereq: junior major. 4 cr.

610C. NURSING OF ADULTS II
Increases the student's ability to make nursing decisions. In clinical practice the student will plan, implement, and evaluate care for selected adult clients experiencing physiological dysfunction. Prereq: junior major. 4 cr.

610D. NURSING IN THE COMMUNITY
Role of the community health nurse in health maintenance and disease prevention for the individual, family, and community. Clinical practice in application of concepts and theories of community health nursing. Prereq: junior major. 4 cr.

610E. NURSING IN MENTAL HEALTH
Mental health concepts and major factors affecting human behavior. Clinical practice focused on the therapeutic nurse-patient relationship as a means to help individuals cope with mental health problems. Prereq: junior major. 4 cr.

621. NURSING III
Analysis of nursing needs of individuals with multisystem problems. Selected case studies to emphasize the interdependence of the adaptive mechanisms of the biopsychosocial being. 4 cr.

621C. NURSING OF ADULTS III
Exploration and analysis of selected complex nursing problems in the care of ill adults. Clinical practice provides opportunity for synthesis of learning and develops ability to systematically evaluate outcomes of nursing actions. 4 cr.

629. NURSING RESEARCH
Conceptual understanding of the research process; its implication in nursing practice. Includes basic knowledge necessary for development of structural investigation of problems related to nursing. 2 cr.

630. NURSING LEADERSHIP
Leadership theories and process as they apply to nursing; leadership behaviors necessary to facilitate change. 2 cr.

630C. SENIOR PRACTICUM
Clinical experience in an area of the student's interest. Working closely with clinical preceptors and faculty, the student will integrate previously learned knowledge and skills and add to competency as a beginning professional practitioner. 4 cr.

632B. PROFESSIONAL NURSING: COMPETENCY ASSESSMENT
Examination and/or evaluation to determine level of competency within the seven program competency areas. Normally students will be granted from zero to the total number of credits that each competency is worth. The seven program competencies include: 1) apply knowledge of principles common to professional nursing practice to meet basic needs of individuals of all ages in all conditions in any setting; 2) relate concepts from the physical and behavioral sciences to professional nursing practice; 3) demonstrate knowledge of alterations in biopsychosocial functioning throughout the life cycle and the care appropriate to clients with those alterations; 4) apply knowledge of basic teaching-learning theory to design and implement instructional programs for individuals and groups; 5) analyze, develop, and collaborate in beginning-level nursing research in an effort to develop sound theories for nursing practice; 6) utilize the nursing process to establish therapeutic relationships in all aspects of practice in order to provide individualized, prioritized and comprehensive care to clients, families, and community groups; 7) demonstrate the ability to function independently and interdependently, applying theories of leadership and change, acting as a client advocate, and demonstrating accountability and responsibility as a professional nurse. Prereq: Nurs 506B; all nursing major prerequisites; permission. An "IA" grade (continuing course) may be given at the end of one semester. 0-48 cr. Cr/F.

635. OPERATING ROOM NURSING: NURSING PROCESS DEALING WITH SURGICAL STRESSES
Competencies necessary for professional operating room nursing. Modules include preoperative, intraoperative, and postoperative nursing care. 8-week course; 8-hour lab/week. Prereq: RN with New Hampshire licensure; or, for baccalaureate nursing

students who have completed junior year, permission. 4 cr.

640. QUALITY ASSURANCE IN NURSING
Current trends toward quality assurance in fields of health and nursing; approaches to assessment and implementation of quality assurance programs in various practice settings. Prereq: senior major; /or permission. 4 cr.

642. INTRODUCTION TO HEALTH ASSESSMENT TECHNIQUES
Introduces the registered nurse to basic history taking and selected physical examination techniques for application in the adult health care setting. Practice will be provided under the guidance of an instructor in the laboratory setting. Learned skills will be utilized in a clinical practice setting under the guidance of an instructor. Prereq: permission. 4 cr. Cr/F.

670. ISSUES IN HEALTH CARE OF THE AGED
Multidisciplinary study of issues relevant to the health and delivery of services to the elderly. Course divided into two parts: 1) study of the normal physiological and psychological processes of aging, and 2) impact of social, cultural, and economic forces on care of the elderly and their health. Students assigned weekly meetings with a senior citizen to compare and integrate content. Prereq: permission. Open to all students. 4 cr.

690B. PROFESSIONAL NURSING PLAN OF STUDY
Open to students in the EBORN track of the nursing major. After the initial nursing competency assessment is completed (N632B), this course enables students to fulfil the remaining terminal objectives of the nursing major. Prereq: N506B; N632B. 0-46 cr.

695. INDEPENDENT STUDY
In-depth study with faculty supervision. Prereq: junior standing and approval of adviser and faculty of the area concerned. May be repeated for different topics. 2-4 cr.

Nutritional Sciences (Nutr)

(For program description, see page 47)

COORDINATOR: Henry J. Thompson
PROFESSORS: James B. Holter, Samuel C. Smith
ASSOCIATE PROFESSORS: Charles Schwab, Henry J. Thompson
ASSISTANT PROFESSORS: Colette H. Janson, Alan H. Parsons, Anthony R. Tagliaferro

400. ANIMALS, FOOD, AND MAN
Nutrition and food science; biological, social, political, economic, and historical significance of food. Animal food products. 4 cr. (Also offered as AnSc 400.) Nonmajors only.

403. PRINCIPLES OF FOOD PREPARATION AND MEAL MANAGEMENT
Purchasing, planning, preparation, and serving of meals; management of time, money, and energy. 4 cr. (Fall semester only.)

404. PRINCIPLES OF INSTITUTIONAL FOOD PREPARATION
Practical experience in methods of purchasing, administering, and handling food, tools and heavy equipment used in quantity food preparation; lab experience in selective settings. Prereq: basic food preparation. 4 cr. (Spring semester only.)

475. NUTRITION IN HEALTH AND DISEASE
Principles of normal and therapeutic nutrition; changes in nutrient requirements throughout the life cycle and in disease processes. 3 cr. (Fall semester only.) Nonmajors only.

500. INTRODUCTION TO FOOD SCIENCE
Fundamental concepts of chemistry underlying food preparation and food technology. Prereq: courses in food preparation and inorganic chemistry. Coreq: Nutr 501. 3 cr. (Spring semester only.)

501. FOOD SCIENCE LAB
Lab techniques involving food preparation and the principles of food preservation and processing. Must be taken concurrently with Nutr 500. 1 cr. (Spring semester only.)

605. PRINCIPLES OF NUTRITION
Principles underlying nutrition of humans and animals; digestion, absorption, intermediate metabolism, and excretion of nutrients; function of nutrients in maintenance, growth, and production; metabolic disorders resulting from inappropriate intake of nutrients and from diseases. Prereq: 1 year of chemistry; 1 semester of physiology. Lab. (Also offered as AnSc 605.) 4 cr.

610. COMMUNITY NUTRITION
Focus is on techniques used in assessing and improving the health status of groups; techniques of data evaluation, interpretation, and nutrition education are emphasized. Prereq: basic nutrition course. 4 cr. (Spring semester only.)

700. CRITICAL ISSUES IN NUTRITION
Critical review and analysis of controversial topics in nutrition; emphasis on developing analytical writing skills. Prereq: basic nutrition course. 3 cr. (Fall semester only.)

709. BIOCHEMISTRY OF NUTRITION
Intermediary metabolism of nutrients and energy; metabolism transport mechanisms; biological oxidations; interrelationships of carbohydrate, fat, and protein metabolism; obesity; control of hunger and appetite. Prereq: college course in biochemistry. Lab. (Also offered as AnSc 709.) 4 cr.

710. ANIMAL NUTRITION
Feeding and related management of farm animals with special emphasis on dairy cattle; nutrients and their use, digestive anatomy and physiology, energy systems, forage systems and quality, ration balancing (dairy, beef, sheep, poultry, swine, and equine), and selected metabolic disorders. Prereq: AnSc 605 or permission. (Also offered as AnSc 710) 5 cr.

750. HUMAN NUTRITION
Detailed analysis of the nutrient requirements of man throughout the life cycle. Nutrient needs are evaluated in the context of their physiological and biochemical functions. Prereq: basic nutrition. Coreq: Nutr 751. 3 cr. (Fall semester only.)

751. LABORATORY TECHNIQUES IN NUTRITION
Standard procedures of nutrient analysis. Use of laboratory instruments and techniques to develop quantitative skills. Prereq: organic chemistry or permission; to be taken concurrently with Nutr 750. 2 cr. (Fall semester only.)

774. CLINICAL NUTRITION
Application of principles of normal nutrition and physiology to clinical problems; altered nutrient requirements in human disease. Prereq: basic nutrition and biochemistry or permission. To be taken concurrently with Nutr 775. 3 cr. (Spring semester only.)

775. NUTRITIONAL ASSESSMENT LABORATORY
Experimental techniques in anthropometric and biochemical assessment of nutritional status emphasizing principles of normal nutrition and changes induced by disease. Prereq: basic nutrition or permission. To be taken concurrently with Nutr 774. 2 cr. (Spring semester only.)

780. PRACTICAL APPLICATIONS IN CLINICAL NUTRITION
Supervised practical experience in dietetics in one of several cooperating New Hampshire hospitals. Emphasis on patient interviewing, evaluation, counseling, and instruction. To be taken concurrently with Nutr 774 and 775. 5 cr. (Spring semester only.)

Occupational Education (OcEd)

(For program description, see page 47)

CHAIRPERSON: William H. Annis
PROFESSORS: William H. Annis, Maynard C. Heckel
ASSOCIATE PROFESSOR: Lewis Roberts, Jr.
ASSISTANT PROFESSORS: Gregory D. Gill, David L. Howell
THOMPSON SCHOOL ASSISTANT PROFESSOR: Thomas A. March
INSTRUCTOR: Stephen Lichtenstein

440. CONCEPTS OF CAREER EDUCATION
Examines the four major roles of people and how these roles apply to learning in a university setting. The four roles are: 1) family member; 2) citizen; 3) worker; and 4) user of leisure time. Through this concept of career education students develop skills to: 1) use the concept as a teaching or learning strategy; 2) explore their individual areas for improvement; 3) relate their present and future classes to employment; 4) enter the world of work; and 5) develop flexibility for changes that may occur in the future. 4 cr.

451. METAL WORK I
Arc and oxyacetylene welding and basic metal work. The knowledge needed to select materials, tools, and equipment; and development of skills to perform basic metal work. Lab. 3 cr.

452. METAL WORK II
Advanced arc and oxyacetylene and basic GMAW and GTAW welding. Topics include vertical and overhead welding and the joining of common metals other than mild steel. Prereq: OcEd 451; permission. Lab. 3 cr.

461. INTERNAL COMBUSTION ENGINES, PRINCIPLES AND MAINTENANCE
Internal combustion engines and their components with emphasis on how they function, preventive maintenance, and troubleshooting. Prereq: Permission. Lab. 3 cr.

462. INTERNAL COMBUSTION ENGINES, REPAIR AND OVERHAUL
Principles and techniques of engine overhaul. Each student is required to provide and overhaul, to factory specifications, at least one 4-stroke cycle engine. Prereq: OcEd 461; permission. Lab. 3 cr.

470. RESIDENTIAL ELECTRICITY
Electrical principles, laws, and installation with emphasis on the National Electrical Code. Prereq: permission. Lab. 3 cr.

475. BASIC CARPENTRY
Fundamentals of basic carpentry with emphasis on residential carpentry. Each student is required to plan and construct an approved project. Prereq: permission. Lab. 3 cr.

500. OCCUPATIONAL COMPETENCY EXAMINATION AND EVALUATION
Examination and/or evaluation to determine the level of competency within occupational clusters. Restricted to OcEd majors. Prereq: permission. 0-30 cr. Cr/F.

550. PRINCIPLES OF OCCUPATIONAL EDUCATION
An examination of the principles on which occupational education and the Cooperative Extension Service are based. Includes historical and legislative development at both the state and federal levels with emphasis on current issues and problems. Required of majors and minors in OcEd. 4 cr.

650. MICROTEACHING
Organization and presentation of microlessons. Preliminary experience and practice in teaching. Variables of classroom teaching under controlled conditions. Videotaping for immediate feedback. Substitutes for Educ 703. Required of majors and minors in OcEd. Prereq: Educ 500 or permission. 1-4 cr.

652. CONCEPTS OF FFA AND SOEP
Development and guidance of the FFA and Supervised Occupational Experience Programs for high school youth. Required for preservice agricultural teachers in occupational education. 4 cr.

666. VOCATIONAL EDUCATION FOR THE DISADVANTAGED LEARNER
Vocational education and its responsibilities in serving disadvantaged learners. Legislative perspective, identification of disadvantaged learners, individual vocational education programs, skills and competencies, exemplary programs, current issues and problems. Prereq: Educ 500 or permission. 4 cr.

695. INVESTIGATIONS IN OCCUPATIONAL EDUCATION
A) Career Education; B) Secondary Education; C) Post-Secondary Education; D) Adult Education;

E) Extension Education; F) Exemplary Education; G) Cooperative Education; H) Disadvantaged and Handicapped Education. An opportunity for undergraduates to address a special problem. Prereq: permission. May be repeated. 2-4 cr.

696. FIELD EXPERIENCE
Work with an agency, institution, or organization to gain technical and/or professional competence not otherwise available. Student plans experience with departmental adviser. Credit approval subject to recommendation of faculty members and performance of student. Limited to OcEd majors and minors. Prereq: permission. May be repeated up to 16 credits. 2-16 cr.

700. WORKSHOPS IN OCCUPATIONAL EDUCATION
Modularized instruction for in-service education of teachers of vocational education and others in occupational education. May be repeated up to 8 credits. 1-2 cr.

750. SHOP ORGANIZATION AND CONTROL METHODS
Purposes: 1) to examine all facilities of vocational programs in New Hampshire to insure safety, quality instruction, and adequate use of space; 2) to examine the role of the vocational instruction relating to liability, maintenance of equipment, planning for improvements in facilities, and planning for new facilities. 4 cr.

783. CONDUCTING AND SUPERVISING ADULT EDUCATION PROGRAMS
Analysis of formal and informal adult education programs; development of strategies of program planning, instruction, evaluation, and supervision. 4 cr.

784. THE COMMUNITY-JUNIOR AND VOCATIONAL-TECHNICAL COLLEGES
Rise and development of community-junior colleges and two-year vocational-technical colleges in American education; their history, potential, philosophy, and functions. 4 cr.

791. PLANNING FOR TEACHING
Organization of materials of instruction to meet group and individual needs. Techniques of instruction, planning for teaching, function of consulting committees, working with youth groups, program evaluation. Course scheduled concurrently with Educ 694. Prereq: OcEd 650. 4 cr.

796. INVESTIGATIONS IN OCCUPATIONAL EDUCATION
A) Career Education; B) Secondary Education; C) Post-Secondary Education; D) Adult Education; E) Extension Education; F) Exemplary Programs; G) Cooperative Education Programs; H) Disadvantaged and Handicapped Education Programs. Student-selected problems in one of the areas listed. Elective after consultation with the instructor. Hours to be arranged. May be repeated. 2-4 cr.

798. OCCUPATIONAL EDUCATION SEMINAR
Discussion of current issues, problems, and research and development in OcEd. Students, faculty, and other personnel serve as discussion leaders. Required of OcEd majors and minors. 0-2 cr. (Fall semester only.)

Occupational Therapy (OT)

(For program description, see page 70)

CHAIRPERSON: Barbara Sussenberger
ASSOCIATE PROFESSORS: Alice Crow-Seidel, Barbara Sussenberger, Ann D. Ury, Judith D. Ward
ASSISTANT PROFESSORS: Elizabeth L. Crepeau, Gail J. Licciardello, Beth Seybold Strassler
LEVEL I FIELDWORK COORDINATOR: Alice Crow-Seidel
LEVEL II FIELDWORK COORDINATOR: Elizabeth L. Crepeau
MEDICAL LECTURER: Luigi N. Dolcino, M.D., Kenneth O'Neil, M.D.

The following courses are for occupational therapy students; elective for others by permission of the course instructor.

400. HEALTH-HUMAN VALUES
Physiological, emotional, social, and environmental factors affecting health. Basic health information to broaden understanding of health-related issues. Students examine their patterns of decision making in issues directly affecting their lives. Also offered as SHS 400. 4 cr.

510. OCCUPATIONAL THERAPY THEORY I
Concepts and historical perspectives of the basic theories and techniques. Fundamentals of evaluation, testing, and problem solving; planning and administering treatment. Prereq: sophomore OT major. Lab. 4 cr.

512. TREATMENT MEDIA ANALYSIS I
Activity and its relationship to normal human development; teaching and supervising activities programs. Development of skills in treatment media and administration of activity programs. Minimum lab fee: $5. Prereq: OT 510 or permission. 2 cr.

515. TREATMENT MEDIA ANALYSIS II
Analysis of life tasks and human needs with an introduction to therapeutic analysis. Media explored for skill development and adaptation to treatment. Exposure to client population for practical application of acquired skills. Minimum laboratory fee: $12. Prereq: OT 512. Lab. 4 cr.

531. GROUP PROCESS
Dynamics and development of group relationships with emphasis on self-awareness and sensitivity to others. Comparison of normal and therapeutic groups. Group processes in practice; role development and leadership concepts. Prereq: sophomore OT major or permission. 2 cr.

581. MEDICAL CONCEPTS FOR OCCUPATIONAL THERAPISTS
Disease as a dynamic process affecting activity; medical and health models. Specific disease conditions addressed by a variety of health professionals. Prereq: Zool 507-508 or permission. 4 cr.

582. OCCUPATIONAL THERAPY THEORY II: REHABILITATION TECHNIQUES
Techniques used by occupational therapists in rehabilitation of physically disabled clients; includes practice. Prereq: PhEd 652; OT 581. 4 cr.

583. OCCUPATIONAL THERAPY: PSYCHIATRIC FOUNDATIONS
Clinical psychiatric conditions presented by a psychiatrist through patient interviews. Recognition of psychiatric symptoms, their cause, and general treatment are emphasized in follow-up sessions. Transportation fee. Prereq: Psyc 401 or permission. 4 cr.

588. LEVEL I FIELDWORK: THREE ONE-WEEK FIELDWORK EXPERIENCES
During each of the sophomore, junior, and senior years, students are required to spend one week in a clinical setting during school breaks or summers. Written evaluation is required for each. Prereq: admission to OT program; permission. 1 cr. Cr/F.

600. DEVELOPMENTAL TASKS OF ADULTHOOD
Includes the biological and psychosocial context of development. Developmental tasks as they relate to the accomplishment of prior tasks, physiological change, socioeconomic status, and psychosocial development. Prereq: Psyc 581 or permission. 4 cr.

624-624L. OCCUPATIONAL THERAPY TREATMENT OF PSYCHOSOCIAL DYSFUNCTION
Current frames of reference for occupational therapy practice in psychiatric/mental health settings. Focuses on client evaluation and treatment methods as well as an overview of program development approaches in mental health systems. Lab. Prereq: OT 531; OT 583. 4 cr.

633. TREATMENT FOR PHYSICAL DISABILITIES
Uses problem-solving model. Opportunity to acquire beginning skills in evaluation, setting of treatment goals, and selection of treatment techniques for clients with physical disabilities secondary to central nervous system dysfunction. Prereq: OT 582. 4 cr.

634. SYSTEMS OF THERAPEUTIC INTERVENTION IN PHYSICAL DISABILITIES
Case observation and simulation of methods of delivery of occupational therapy services and development of treatment plans for clients with physical disabilities. 4 cr.

691. SENIOR PROJECT: DESIGN
Design and independent study in occupational therapy. Choosing and defining a project topic. Exploration of literature and clinical/community resources; defining goals; contract with faculty adviser for approval and supervision. Prereq: senior standing in OT major. 1 cr. Cr/F.

692. SENIOR PROJECT: IMPLEMENTATION
Carrying out a Senior Project that was designed in OT 691; approved and supervised by a faculty adviser. Written report required. Prereq: OT 691. 1 cr.

693. OCCUPATIONAL THERAPY IN THE EDUCATION OF THE SCHOOL-BASED HANDICAPPED CHILD
Roles and functions of the school-based occupational therapist. Theory, evaluation, and treatment are presented in subject modules by a variety of professionals. 4 cr.

695. INDEPENDENT STUDY
In-depth study with faculty supervision. Prereq: junior standing in OT major; approval of major adviser and faculty of area concerned. 2-4 cr.

697. ORGANIZATION AND ADMINISTRATION
Organization and administration of OT services. Practical problem-solving experiences. Development of fundamental research skills. Prereq: senior standing in major. 2 cr.

698. SENIOR SEMINAR
Current professional issues related to transition from the academic to the clinical fieldwork setting. Prereq: senior standing in major and permission. 1 cr. Cr/F.

700. MANAGING RESOURCES FOR THE DEVELOPMENTALLY DISABLED
Analysis and application of various administrative techniques, processes, and systems used in delivering therapeutic services to the developmentally disabled. Professional teamwork examined via case discussions, class exercises, and site visits. Prereq: permission. 4 cr.

711. PSYCHOSOCIAL DYSFUNCTION FIELD WORK
Supervised field experience in off-campus setting for three-month period. Prereq: completion of all requirements for B.S. degree in occupational therapy. Must be completed successfully to qualify to take professional certification exam. 0 cr.

712. PHYSICAL DYSFUNCTION FIELD WORK
Supervised field experience in off-campus setting for three-month period. Prereq: completion of all requirements for B.S. degree in occupational therapy. Must be completed successfully to qualify to take professional certification exam. 0 cr.

713. SPECIAL AREA FIELD WORK
Supervised field experience in off-campus setting for three-month period. Prereq: completion of all requirements for B.S. degree in occupational therapy. Must be completed successfully to qualify to take professional certification exam. 0 cr.

Ocean Engineering

(For program description, see page 51)

Oceanography

(For program description, see page 51)

Philosophy (Phil)

(For program description, see page 31)

CHAIRPERSON: Yutaka Yamamoto
PROFESSORS: Paul T. Brockelman, Asher Moore, Duane H. Whittier
ASSOCIATE PROFESSORS: R. Valentine Dusek, Neil B. Lubow, Robert C. Scharff, Yutaka Yamamoto
ASSISTANT PROFESSOR: Barbara S. Tovey
INSTRUCTORS: Andrew Christie, Timm Triplett

Introduction to Philosophy: The 400-level courses (except 495) listed below are all introductions to philosophy; students should select among them according to interest.

401. GENERAL INTRODUCTION TO PHILOSOPHY
Depending upon the instructor, the emphasis will be on basic philosophic problems, recurrent types of philosophies, or selected readings from the history of philosophy. 4 cr.

412. BEGINNING LOGIC
Principles of reasoning and development of symbolic techniques for evaluating deductive and inductive arguments. Not open to junior and senior students in EE, CS, and Math; it is recommended that these students take Phil 550. 4 cr.

416. PHILOSOPHICAL SURVEY OF WORLD RELIGIONS
Fundamental literature and ideas of a number of the world's major religious traditions. For example, archaic religions, Hinduism, Buddhism, Taoism, Judaism, Christianity, Islam. 4 cr.

417. PHILOSOPHICAL REFLECTIONS ON RELIGION
Introductory philosophy of religion. To help students become critically aware of philosophical issues involved in various forms of religious belief and some of the persisting philosophical understandings of those issues. 4 cr.

421. PHILOSOPHY AND THE ARTS
Contemporary philosophic concerns and perspectives as reflected in one or more of the arts (literature, theater, film, music, plastic art). 4 cr.

424. SCIENCE, TECHNOLOGY, AND SOCIETY
Consideration of the scientific endeavor and its social import from a philosophical perspective. 4 cr.

430. SOCIETY AND MORALS
Critical study of principles and arguments advanced in discussion of current moral and social issues. Possible topics: violence, rules of warfare, sexual morality, human rights, punishment, abortion. 4 cr.

435. THE HUMAN ANIMAL
Philosophy of biology and the evolutionary process. Readings of scientists and philosophers' commentary on scientists. Examination of the differences between scientific debate and philosophic debate. Philosophical study of scientific theory stressing humans' place in the natural world and the ethical implication of humans as natural beings in the evolutionary process. 4 cr.

475. PHILOSOPHICAL REFLECTIONS ON EDUCATION
Philosophical study of the nature, significance, and place of education within the human condition. Students begin to work out and articulate their own attitudes toward the basic issues which lie at the heart of education at all levels. 4 cr.

495. TUTORIAL READING
Basic introductory reading under faculty direction on topics of philosophical importance. Books offered for tutorial reading may be in any area the instructor chooses or on an independent study basis. Prereq: permission. Variable to 4 cr.

496. PHILOSOPHIC TOPICS
Introductory-level seminar in specific topics or problems (e.g., death, love, friendship) considered from a philosophic point of view. 4 cr.

For special introductory courses in the area of applied philosophy, see Fundamentals of Applied Philosophy, p. 146.

520. INTRODUCTION TO EASTERN PHILOSOPHY
Major Eastern traditions of philosophy. Concentration on Indian, Chinese, and Japanese systems may vary from semester to semester. 4 cr.

530. MORAL PHILOSOPHY
Critical examination of the development of philosophical thinking regarding human values, rights, and duties. 4 cr.

550. LOGIC
Principles and techniques of modern logic. Topics: propositional logic, truth tables, predicate logic, and, time permitting, basic metatheorems. Phil 412 is recommended for students without a sound high school mathematics background. 4 cr.

570. ANCIENT PHILOSOPHY
Development of Western philosophy from its beginnings in Greece to the Roman period, with particular emphasis on the thought of Plato and Aristotle. 4 cr.

571. MEDIEVAL PHILOSOPHY
Philosophical thought of the Middle Ages from inception in the late Roman period with thinkers such as Plotinus and Augustine through the late Medieval speculative mysticism of such figures as Meister Eckhart. Writings of Augustine and Thomas Aquinas. 4 cr.

572. MODERN PHILOSOPHY: RATIONALISM
Continental European philosophers of the 17th and 18th centuries including Descartes, Leibniz, Spinoza, and Kant. 4 cr.

573. MODERN PHILOSOPHY: EMPIRICISM
British empiricists of the 17th and 18th centuries; e.g., Locke, Berkeley, and Hume; perhaps concluding with Kant's reaction to empiricism. 4 cr.

577. 19TH-CENTURY PHILOSOPHY
Important 19th-century philosophical movements such as later German idealism, French positivism, utilitarianism, pragmatism, Marxism, existentialism, and vitalism. Prereq: Phil 572 or 573; /or permission. 4 cr.

600. PHILOSOPHY THROUGH LITERATURE
Philosophical implications of representative literary works; content variable. 4 cr.

610. TOPICS IN AMERICAN PHILOSOPHY
Philosophical movements such as pragmatism and process philosophy. Readings from figures such as Peirce, James, Dewey, Santayana, Whitehead, and C.I. Lewis. Prereq: two courses in history of philosophy (one of which may be concurrent); /or permission. 4 cr.

615. TOPICS IN ANALYTIC PHILOSOPHY
The analytic methods applied to the solution of philosophic problems. Typical readings: Russell, Moore, Wittgenstein, Ayer, Ryle, and Austin. Prereq: two courses in history of philosophy (one of which may be concurrent); /or permission. 4 cr.

620. RECENT EUROPEAN PHILOSOPHY
Major developments and themes. Representative figures: Jaspers, Husserl, Heidegger, Bloch, Lukacs, Habermas, Bergson, Marcel, Sartre, Merleau-Ponty, Ricoeur, Kolakowski, etc. Prereq: two courses in history of philosophy (one of which may be concurrent); /or permission. 4 cr.

630. PHILOSOPHY OF THE NATURAL SCIENCES
Philosophical problems raised by the physical and biological sciences; role of mathematics in science, nature of scientific concepts of space and time, relations of science to common sense, relation of theory to observation, logic of scientific discovery, nature of historical changes in scientific worldview, relation of logic of science to the psychology and history of science. 4 cr.

635. PHILOSOPHY OF LAW
Systematic study of salient features of legal systems. Possible topics: nature of law; concept of legal validity; law and morality; individual liberty and the law; legal punishment; legal responsibility and related concepts (for example, legal cause, harm, *mens rea,* negligence, strict liability, legal insanity). 4 cr.

640. KANT AND HEGEL
Kant and Hegel. Prereq: two courses in history of philosophy; /or permission. 4 cr.

650. LOGIC: SCOPE AND LIMITS
Close examination of the scope and limits of formal systems. Variable content: consistency and completeness of predicate logic; Godel's proof and the formalization of mathematics; modal and deontic logic; set theory; finite automata and computing machines; and formal semantics. Prereq: Phil 550; Math 531;/equivalents or permission. 4 cr.

690. INTERDISCIPLINARY STUDIES
Interdisciplinary studies of philosophical issues arising in one or more areas of specialization outside the department. 4 cr.

699. SENIOR THESIS
Tutorial work for philosophy department candidates for "Commendation" and "Honors." Prereq: two courses in history of philosophy, senior standing, and permission. 4 cr. Cr/F.

710. PHILOSOPHY OF RELIGION
Philosophic nature and significance of religious experience; historical and systematic analysis of such traditional issues as the nature of faith, relation of faith to reason, arguments concerning the existence and nature of God, the problem of evil, the relationship of religion and morality, and the relationship of religion and science. Prereq: two courses in history of philosophy; /or permission. 4 cr.

715. ETHICS
Problems in ethical theory. Topics may include the utilitarian-deontologist dispute, analysis of moral language, problem of justification, and various conceptions of morality. Prereq: Phil 530; /or permission. 4 cr.

720. PHILOSOPHICAL PSYCHOLOGY
Philosophical perspectives and problems concerning human nature or the human condition; e.g., the nature of "self," human action, the body-mind problem, freedom of the will, the meaning of "person," the nature of behavior, etc. Prereq: two courses in history of philosophy; /or permission. 4 cr.

725. PHILOSOPHY OF THE SOCIAL SCIENCES
Nature of explanation and understanding in the social sciences. Similarities and differences between the social and physical sciences; claims of objectivity and of subjectivity in the social sciences; role of values in the social sciences. Prereq: two courses in history of philosophy; /or permission. 4 cr.

735. SOCIAL AND POLITICAL PHILOSOPHY
Important concepts in social and political philosophy such as natural rights, revolution, law, freedom, justice. Variable content. Prereq: two courses in history of philosophy; /or permission. 4 cr.

740. AESTHETICS
Philosophic inquiry into art and beauty. Prereq: two courses in history of philosophy; /or permission. 4 cr.

745. PHILOSOPHY OF LANGUAGE
Contemporary philosophical studies of the nature of meaning and structure of language. Prereq: two courses in history of philosophy; /or permission. 4 cr.

750. PHILOSOPHY OF HISTORY
Nature of historical knowledge, efforts to discover patterns of meaning in the past. Prereq: two courses in history of philosophy; /or permission. 4 cr.

755. METAPHYSICS
Advanced and detailed study of one or more important questions or schools of metaphysics; e.g., nature of being, nature of reality, relationship of thought and reality. Prereq: two courses in history of philosophy; /or permission. 4 cr.

760. EPISTEMOLOGY
Theory of knowledge; nature of knowledge and belief; nature of perception; theories of truth. Prereq: two courses in history of philosophy; /or permission. 4 cr.

780. SPECIAL TOPICS IN PHILOSOPHY
Advanced study of special topics: e.g., a problem, figure, or movement in the history of philosophy; or selected issues, thinkers, or developments in contemporary philosophy. Prereq: two courses in history of philosophy; /or permission. 4 cr.

795, 796. INDEPENDENT STUDY
For students who are adequately prepared to do independent, advanced philosophical work; extensive reading and writing. Before registering, student must formulate a project and secure the consent of a department member who will supervise the work. Conferences and/or written work as required by the supervisor. 1-4 cr.

Fundamentals of Applied Philosophy

The following are introductory courses on the fundamentals of philosophy in practice. Special emphasis is placed on identifying and reflecting on philosophical issues that arise in the context of one's professional as well as everyday life. They are designed to interest those who wish to examine the broader philosophical implications of their chosen professional activity and also those who share the awareness that, in today's world, a systematic value-orientation must complement one's scientific knowledge and skills.

660. LAW, MEDICINE, AND MORALS
Critical examination of the diverse legal and moral issues facing the profession of health care. Variable topics. Possible topics: duty to provide care; nature of informed consent to treatment; problems of allocating limited health care resources (e.g., withdrawal of life-support systems, quality-of-life decisions, etc.); patient's right to confidentiality; problems relating to involuntary preventive care (e.g., involuntary sterilization, psycho-surgery, etc.). 4 cr.

675. COMPUTERS AND SOCIETY
Philosophical and social implications of the "Computer Revolution." Five topical parts: historical development of the computer; automata and the concept of mind and man; computers and empirical science; the automation of management; prospects for future socio-cybernetic developments. 4 cr.

683. TECHNOLOGY: PHILOSOPHICAL AND ETHICAL ISSUES
The bases of modern technology in, and its impact upon, people's philosophic conceptions of themselves and their world. Ethical, social, political, and ecological implications of technology. Risk and benefit criteria. Technological and humanistic philosophies of life. 4 cr.

Physical Education (PhEd)

(For program description, see page 71)

CHAIRPERSON: D. Allan Waterfield
ASSOCIATE PROFESSORS: Katherine Amsden, Gavin H. Carter, Phyllis A. Hoff, Robert Kertzer, D. Allan Waterfield, Robert E. Wear, Walter E. Weiland
ASSISTANT PROFESSORS: Lori A. Alexander, Thomas R. Barstow, D. Michael McKeough, B. Joyce Mills, Nancy C. Rupp
FACULTY IN RESIDENCE: Michael A. Gass
LECTURERS: Frank C. Helies, Jr., Darcy P. Holland

FACULTY FROM THE DEPARTMENTS OF INTERCOLLEGIATE ATHLETICS
ASSISTANT PROFESSORS: Lionel J. Carbonneau, Theodore W. Conner
LECTURERS: M. William Bowes, Cecelia DeMarco, Carol Ford, Gerald J. Friel, Richard F. Garber, Jr., Gail A. Goodspeed, Nancy L. Krueger, Russell J. McCurdy, Robin E. Meeks, Carol E. Rowe, James H. Urquhart

The Major Program

Prospective physical education majors should refer to pages 64-65 for information regarding the major programs.

The Elective Program

The Department of Physical Education provides an opportunity for students to participate in an elective activity program in a wide variety of sports, aquatics, conditioning, and gymnastics courses. Students may elect up to two credits of activity coursework per semester. Courses offered include: aquatics (basic swimming, advanced lifesaving, water safety instructors' course, and SCUBA), archery, backpacking, badminton, bicycling, figure control, figure skating, fencing, golf, gymnastics, hiking/orienteering, ice hockey, outdoor education, racquetball, rock climbing, basic skating, ski conditioning, skiing, ski touring, squash, tennis, volleyball, weight training, yoga.

The department supplies special uniforms. Students are required to furnish such items as sneakers and bathing caps. A $45 fee is charged for SCUBA; fees are also charged for off-campus activities such as skiing. Students with physical limitations are encouraged to participate in the program on a modified basis. Students may repeat the same level activity for credit with the instructor's approval.

Elective Physical Education Activities

410-456. ELECTIVE PHYSICAL EDUCATION
Activity coursework open to all undergraduates. Cr/F.

Half-Semester Courses (.5 credits each)

410. ARCHERY

411. FIGURE SKATING—BEGINNING

412. FIGURE SKATING—ELEMENTARY/INTERMEDIATE

413. BICYCLING

414. BASIC SKATING

415. GOLF—BEGINNING

416. GOLF—INTERMEDIATE

417. ICE HOCKEY

418. SKI CONDITIONING

420. SKIING—BEGINNING*

421. SKIING—INTERMEDIATE*

422. SKIING—ADVANCED*

423. SKIING—RACING*

424. SKI TOURING—BEGINNING

425. TENNIS—BEGINNING

427. TENNIS—INTERMEDIATE

* Gunstock

428. TENNIS—ADVANCED

429. SPECIAL TOPIC

430. SPECIAL TOPIC

431. SQUASH

432. SKI TOURING—INTERMEDIATE

433. RACQUETBALL—BEGINNING

434. RACQUETBALL—INTERMEDIATE

435. BADMINTON

443. OUTDOOR EDUCATION

Full-Semester Courses (1 credit each)

437. COURT GAMES (RACQUETBALL, SQUASH)

438. FENCING—BEGINNING

439. FENCING—INTERMEDIATE

440. FIGURE CONTROL

441. GYMNASTICS

442. HIKING/ORIENTEERING

447. ADVANCED LIFESAVING

448. SWIMMING—BASIC

451. VOLLEYBALL

452. WEIGHT TRAINING AND CONDITIONING

453. BEGINNING YOGA

454. SPECIAL TOPIC

455. SPECIAL TOPIC

456. INTERMEDIATE YOGA

461. BASIC SAILING

462. BASIC CANOEING

463. BASIC ROCK CLIMBING

464. INTERMEDIATE ROCK CLIMBING

465. BASIC ICE CLIMBING

466. BASIC BACKPACKING

467. INTERMEDIATE BACKPACKING

468. WINTER WILDERNESS BACKPACKING

Activities for Physical Education Majors

470-492. MAJOR ACTIVITY COURSEWORK
Performance skills and beginning teaching methods.

470. GYMNASTICS 1 cr.

471. OUTDOOR EDUCATION 1 cr. Cr/F.

472. EDUCATIONAL GYMNASTICS 1 cr.
Gymnastics in movement education emphasizing the problem-solving method of teaching.

473. TRACK AND FIELD 1 cr.

474. FOLK, SQUARE, AND SOCIAL DANCE .5 cr.

475. CONDITIONING .5 cr.

476. VOLLEYBALL .5 cr.

477. TENNIS .5 cr.

478. LEAD-UP GAMES .5 cr.

479. ACTIVITIES FOR ELEMENTARY SCHOOL .5 cr.

480. WRESTLING .5 cr.

482. MEN'S LACROSSE .5 cr.

483. BASEBALL .5 cr.

484. SOFTBALL .5 cr.

486. WOMEN'S LACROSSE .5 cr.

487. FIELD HOCKEY .5 cr.

488. FUNDAMENTALS OF MODERN DANCE .5 cr.

490. BASKETBALL .5 cr.

492. SOCCER .5 cr.

Theory Courses

500. PERSPECTIVES IN PHYSICAL EDUCATION
An introduction to the profession of physical education, including concentrations on the historical, sociological, and adapted perspectives. 4 cr.

501. ADVANCED FIRST AID AND EMERGENCY CARE
American National Red Cross program in advanced first aid and emergency care. 2 cr. Cr/F.

502. BASIC ATHLETIC TRAINING
Etiology, pathology, acute care, and prognosis of sports injuries. Lab. 4 cr.

503. ATHLETIC TRAINING APPLIED TECHNIQUES
Theory and lab in preventive and safety techniques including taping, wrapping, and padding. This course is designed to fulfill clinical skill competencies proposed by the NATA. 2 cr. Cr/F.

520. WATER SAFETY INSTRUCTORS' COURSE
Analysis of aquatic techniques; methods of teaching swimming, diving, and lifesaving. A.R.C. instructor authorization awarded to candidates with high caliber of personal skill, knowledge, and

teaching ability. Prereq: current advanced lifesaving certification. 2 cr.

521. THEORY OF COACHING BASKETBALL
Individual and team offense and defense; rules of the game. Problems in team handling and conditioning. Prereq: PhEd 490. 2 cr.

522. THEORY OF COACHING FOOTBALL
Systems of play; team and individual offensive and defensive fundamentals; theory and strategy of team play; coaching methods, physical conditioning; rules. 2 cr.

523. THEORY OF COACHING HOCKEY
Basic hockey skills. Fundamentals of individual and team offense and defense; coaching methods; rules. 2 cr.

524. THEORY OF COACHING BASEBALL
Batting and fielding; fundamentals of each position; problems of team play; coaching methods; physical conditioning; rules. Prereq: PhEd 483 or 484. 2 cr.

525. THEORY OF COACHING SOCCER
Fundamental and advanced skills and techniques; offensive and defensive principles of team play; tactical formations and strategy; methods of training and practicing; rules. Prereq: permission. 2 cr.

526. THEORY OF COACHING WRESTLING
Theory, practical teaching methods, and the development of skills and techniques from basic maneuvers to the more advanced. Prereq: PhEd 480. 2 cr.

527. AQUATIC LEADERSHIP TRAINING
Methods, organization, and administration of A.R.C. and YMCA aquatic programs. Methods of teaching swimming, diving, and lifesaving; program planning; officiating; operation and maintenance of swimming pools; camp waterfront; health and safety aspects of aquatic programs; legal problems; skin and SCUBA diving; drownproofing. Students may obtain WSI certification. Prereq: current advanced lifesaving certificate. 2 cr.

528. THEORY OF COACHING TRACK AND FIELD
Starting, sprinting, middle-distance and distance running, relay, hurdling, high and broad jumping, pole vault, shot putting, discus, hammer, and javelin. Methods of training and practicing. Prereq: PhEd 473. 2 cr.

529. THEORY OF COACHING GYMNASTICS
Theory, practical teaching methods, and officiating. Construction of gymnastic routines, from elementary to international level. Prereq: PhEd 470. 2 cr.

530. THEORY OF COACHING SWIMMING AND DIVING
Philosophy, historical development, and psychological theories of coaching. Mechanical and kinesiological aspects of the competitive strokes and required optional dives, low and high board. Prereq: PhEd 447. 2 cr.

531. THEORY OF COACHING FIELD HOCKEY
Analysis of field hockey coaching techniques. New systems of play; use of interval training for preseason conditioning and inseason practices. Prereq: PhEd 487 or permission. 2 cr.

532. THEORY OF COACHING RACQUET SPORTS
Thorough and indepth knowledge of the administration and coaching of major racquet sports: badminton, racquetball, squash, and tennis. Prereq: permission. 2 cr.

533. BASIC SCUBA
Pool and classroom instruction in SCUBA fundamentals, N.A.U.I. certification for successful completion of course and 3 open water dives. Strong swimming ability required. $45 fee. 2 cr.

550. OUTDOOR EDUCATION PHILOSOPHY AND METHODS
The rationale and basic structure of effective teaching techniques and procedures for outdoor education; uses an interdisciplinary approach; 3 lecture hours and field experience required. 4 cr.

552. CAMP LEADERSHIP COURSE
An introductory course for training future leaders in areas of camp counseling and outdoor living skills in a variety of settings and programs; 3 lecture hours and lab/field experiences. 4 cr.

563. THE THEORY OF TEACHING PHYSICAL EDUCATION IN THE SECONDARY SCHOOL
Teaching methods. Lab. Prereq: minimum of 6 credits from coursework numbered PhEd 470-492; Educ 500. 4 cr.

606. NEUROLOGY
Morphology, physiology, and histology of the human nervous system. Lab. Prereq: Zool 507-508. 4 cr.

610. ADAPTED PHYSICAL EDUCATION
Common disorders of handicapped children; practical experience in the remediation of those disorders through the use of adapted physical education activities. Lab. Prereq: Zool 507-508. 4 cr.

620. PHYSIOLOGY OF EXERCISE
Acute and chronic effects of exercise. Muscle physiology, respiration, cardiac function, circulation, energy metabolism, and application to training. Prereq: Zool 507-508. 4 cr.

621. EXERCISE LABORATORY TECHNIQUES
Administration of graded exercise tests on treadmill, bicycle ergometer, and stepping bench. Monitoring physiological variables during the graded exercise test. Calculation of metabolic data resulting from the exercise test. Prereq: PhEd 620. 3 cr.

625. DYNAMICS OF HUMAN MOVEMENT
Kinesiological consideration of factors which affect efficiency. Cinematographic and non-cinematographic forms of analysis of selected movement events and sequences. Prereq: Zool 507-508. (Not open to students who have taken PhEd 652). Lab. 4 cr.

630. EVOLUTION OF SPORT
Sports as an institution in selected geographical areas of the world. Relationship to war, art, and religion; ritualistic role; historic use by nations. Primarily for nonmajors. Prereq: permission. 4 cr.

633. SOCIAL FOUNDATIONS OF SPORT AND PHYSICAL ACTIVITY
Interdependence of human movement experiences, as exemplified in sport, play, and games, and various cultural, subcultural, and social factors. Prereq: Soc 400. 4 cr.

635. SPORT IN LITERATURE
Survey of sport as it is recorded in literature, both classical and contemporary, and the effect of sport on writing. 4 cr.

636. INTRODUCTION TO SPORTS INFORMATION
Basic concepts of sports information related to preparation of material for public relations including radio, television, and publications. Includes guest lecturers and work in the UNH Sports Information Office. 2 cr.

637. SPORT—AN ETHOLOGICAL APPROACH
Survey of ethology (animal behavior). Ethological principles applied to the development and conduct of sports and to other disciplines such as psychology, sociology. Prereq: Soc 411, or permission. 4 cr.

650. EXERCISE SPECIALIST INTERNSHIP
A one-semester internship in an agency that offers physical activity programs of prevention, intervention, and rehabilitation. Activities include graded exercise testing, exercise prescription, and exercise session leadership. Prereq: open only to students who are enrolled in the exercise specialist option and have completed all requirements for the option. 8 cr.

652. CLINICAL KINESIOLOGY
The science of human motion. Human muscular anatomy; actions of skeletal muscles using electromyographic evidence. Applications of concepts of muscle physiology and biomechanics to physical education activities. Lab. Prereq: Zool 507-508. (Not open to students who have taken PhEd 625.) 4 cr.

668. MEASUREMENT PROCEDURES IN PHYSICAL EDUCATION
Essential elementary statistical methods; measurement data scientifically evaluated for application to the program. Lab. 4 cr.

675. MOTOR DEVELOPMENT OF THE YOUNG CHILD
Characteristics of motor behavior across time, and the role of movement in a child's total development. Growth processes, analysis of movement, variations in movement due to maturation, environment, and experiences. Prereq: PhEd 472 or permission. Lab. 4 cr.

681. THEORY OF ADVENTURE EDUCATION
Basic skills and theories necessary in developing adventure education activities. Prereq: 2 outdoor adventure activity classes and permission. 3 hours of lecture and field experience. 4 cr.

692. THEORIES OF TEACHING PHYSICAL EDUCATION IN THE ELEMENTARY SCHOOL
Current theories and methods; consideration given to growth and developmental needs in curriculum planning. Prereq: 6 credits from PhEd 470-492; Educ 500; PhEd 675. Lab. 4 cr.

696. INDEPENDENT STUDY
In-depth study. Prereq: PhEd major with junior standing and approval of academic adviser and department chairperson. 2-4 cr.

702. ADVANCED ATHLETIC TRAINING
Assessment, rehabilitative treatment, preventive strapping, and protective equipment used in athletic training. Administration of a training room facility. Lab. Prereq: PhEd 502. 4 cr.

703. LABORATORY PRACTICE IN ATHLETIC TRAINING
150 hours of experience in UNH athletic training room under N.A.T.A. certified trainer. Prereq: PhEd 502. May be repeated up to 8 cr. 2 cr.

710. UNDERWATER RESEARCH METHODS
Lecture, open water, and pool instruction in underwater research techniques and hyperbaric physiology lab. Prereq: basic certification and permission. Fee. 4 cr.

720. INTERPRETATION AND ASSESSMENT OF PHYSICAL FITNESS
Planning and implementation of programs of conditioning and fitness in the general program of education in the school. Personal fitness; components of physical fitness and conditioning; current tests; rehabilitation of individuals of all ages, particularly in college and adult programs. Prereq: PhEd 620 or equivalent. 4 cr.

722. GRADED EXERICISE AND EXERCISE PRESCRIPTION
Graded exercise testing and its application to the prescription of exercise. Special emphasis on the patient with cardiovascular disease. Prereq: PhEd 620. 4 cr.

730. CURRICULUM PLANNING IN PHYSICAL EDUCATION
Criteria and factors involved in planning and construction of school programs. 4 cr.

731. CONDITIONING FOR MAXIMUM PERFORMANCE
Anatomical and physiological factors related to maximum physical performance. Evaluation of present programs of training. Prereq: PhEd 620 or equivalent. 4 cr.

732. ELECTROCARDIOGRAPHY
An introduction to the reading and assessment of EKG's. Prereq: PhED 620 or equivalent. 4 cr.

740. PERCEPTUAL MOTOR DYSFUNCTION
Theoretical rationale and clinical perceptual-motor training programs of Ayres, Kephart, Cratty, Barsch, and Getman, as they related to sensory-motor integration and the remediation of learning disabilities. Prereq: PhEd 775, or permission. 4 cr.

750. ANALYZING TEACHING IN PHYSICAL EDUCATION
Examination of teaching practices, theories, and research implications. Varied approaches to the study and improvement of teaching, including analysis of films and tapes. Prereq: PhEd 563 or 692 or permission. 4 cr.

775. PERCEPTUAL MOTOR LEARNING
Variables affecting the learning and performance of skilled activity; ability and motivational characteristics of the learner; processes for skill acquisition. Prereq: Psyc 401. Lab. 4 cr.

780. PSYCHOLOGICAL FACTORS IN SPORT
Factors of outstanding athletic achievement; psychological variables in competition; the actions and interactions of sport, spectator, and athlete. Prereq: Psyc 401 or PhEd 775. 4 cr.

791. HISTORY OF PHYSICAL EDUCATION
From ancient Egypt to modern times. Influences of Greece, Rome, the Renaissance and Reformation periods, and modern European nationalism. Analysis of events and the beliefs of leaders in the development of systems of physical education. 4 cr.

Physics (Phys)

(For program description, see page 64)

CHAIRPERSON: Roger L. Arnoldy
PROFESSORS: Roger L. Arnoldy, L. Christian Balling, Edward L. Chupp, John F. Dawson, Lennard A. Fisk, Jr., Jochen Heisenberg, Robert E. Houston, Jr., Richard L. Kaufmann, Robert H. Lambert, John A. Lockwood, Lyman Mower, John E. Mulhern, Jr., Harvey K. Shepard, William R. Webber, John J. Wright
ASSOCIATE PROFESSOR: Robert E. Simpson.
RESEARCH ASSOCIATE PROFESSORS: John R. Calarco, Joseph Hollweg

401-402. INTRODUCTION TO PHYSICS I AND II
Broad survey of classical and modern physics. Designed to enable students to appreciate the role of physics in today's society and technology. Emphasis on the fundamental laws of nature on which all science is based, with some examples of interest to biologists. Knowledge of high school algebra and trigonometric functions essential. Lab. 4 cr.

405. CONCEPTS OF PHYSICS
Descriptive course investigating a limited number of important physical systems. Emphasis on how the system is to be investigated and the patterns in which the results fall. Intuitive concepts used in investigations traced into their application in modern physics. Patterns of thought in physics related to patterns of thought in liberal arts. Recommended for liberal arts juniors and seniors. 4 cr.

406. INTRODUCTION TO MODERN ASTRONOMY
Descriptive coverage of contemporary astronomical and astrophysical techniques with a review of current knowledge and theories concerning the solar system, galaxies, and the universe. Recommended for liberal arts and beginning science students. Lab. 4 cr.

407-408. GENERAL PHYSICS I AND II
Introductory course emphasizing mechanics, and electromagnetism. Recommended for the student specializing in science and engineering. Prereq: thorough knowledge of algebra and trigonometry; Math 425 for 407, and Math 426 for 408, or taken concurrently. Students may not receive credit for both 401 and 407 (or 402 and 408). Lab. 4 cr.

411. HOUSEHOLD PHYSICS
Practical, nonmathematical introduction to the physical principles necessary to understand how and why common devices work. Emphasis on household appliances and automobiles. Classroom demonstrations and laboratories to illustrate theories and practical applications. Prereq: permission. Students may receive credit for either 411 or 412, but not both. 4 cr.

412. TECHNICAL PHYSICS
An introductory course in physics emphasizing the fundamentals of mechanics, heat, electricity, and other subjects underlying modern machinery and instruments. Recommended for Thompson School students. Prereq: algebra, trigonometry; permission. Students may receive credit for either 411 or 412, but not both. Lab. 4 cr.

505. GENERAL PHYSICS III
Fluid dynamics, thermodynamics, kinetic theory, optics, wave motion, introduction to modern physics. Prereq: Phys 407; Math 425, 426. Lab. 4 cr.

516. PHYSICAL MECHANICS
Analytical treatment of classical mechanics covering dynamics of particles and rigid bodies. Newton's laws, conservation theorems, oscillations, central force problem, generalized coordinates, and Lagrange's equations. Prereq: Phys 505 or equivalent; Math 527 and 528 passed or taken concurrently. 4 cr.

602. THERMAL PHYSICS
Classical and statistical approach to thermodynamics, kinetic theory. Prereq: Phys 505; Phys 516 or equivalent; Math 528. 4 cr.

605-606. EXPERIMENTAL PHYSICS I AND II
Circuit design with passive and active elements, electrical measurements for experimental physics, digital electronics and interfacing techniques. Prereq: Phys 505; Math 527 passed or taken concurrently. Lab. 4 cr.

607. OPTICS
Geometrical optics, electromagnetic theory of light, interference, diffraction, polarization, related phenomena and nonlinear optics, Prereq: Math 527; Math 528. Lab. 4 cr. (Offered if sufficient demand.)

701-702. INTRODUCTION TO QUANTUM MECHANICS I AND II
Modern physics, nonrelativistic Schroedinger equation, the hydrogen atom, applications to atomic and molecular structure. Prereq: Math 527; Math 528; /or permission. Math 646 desirable. 4 cr.

703-704. ELECTRICITY AND MAGNETISM I AND II
Foundation of electromagnetic theory; electrostatics, dielectric theory, electromagnetism, magnetic properties of matter, alternating currents, Maxwell's field theory. Prereq: Math 527; Math 528; /or permission. Math 646 or 745 desirable. 4 cr.

705-706. EXPERIMENTAL PHYSICS III AND IV
Modern physics experiments and special project problems assigned to individual students. Prereq: senior standing in physics. Lab. 4 cr.

710. INTRODUCTION TO MODERN ASTROPHYSICS
Review of the sun, stars, Milky Way, external galaxies, and expansion of the universe. Recent discoveries of radio galaxies, quasi-stellar objects, cosmic black-body radiation, X rays, and gamma rays precede a discussion of Newtonian and general relativistic cosmological models, steady-state/big-bang theories, and matter-antimatter models. Prereq: Phys 516; Math 527; /or permission. 4 cr.

713, 714. SPECIAL TOPICS I AND II
Any selected topics not covered sufficiently in a general course may be studied. 4 cr.

718. INTRODUCTION TO SOLID STATE PHYSICS
Theory underlying the behavior of solids. Transport theory and the interaction of radiation and matter. Operation of semiconducting and superconducting devices and lasers. Prereq: Phys 516; Phys 701; Math 527; Math 528. 4 cr. (Offered if sufficient demand.)

795, 796. INDEPENDENT STUDY
Individual project under direction of a faculty adviser. Prereq: Department permission. 1-8 cr.

Plant Science (PlSc)

(For program description, see page 47)

CHAIRPERSON: Owen M. Rogers
PROFESSORS: George O. Estes, Kurt C. Feltner, J. Brent Loy, Lincoln C. Peirce, Owen M. Rogers, Douglas G. Routley
ASSOCIATE PROFESSORS: Yun-Tzu Kiang, David W. Koch, James R. Mitchell, James E. Pollard, Jerry A. Warren, Otho S. Wells
ASSISTANT PROFESSOR: John M. Roberts
ADJUNCT ASSISTANT PROFESSOR: Merrill C. Hoyle

421. CONCEPTS OF PLANT GROWTH
Fundamentals underlying plant growth and response in natural and modified environments. Lab. 4 cr.

427. LANDSCAPING THE HOME GROUNDS
Design and maintenance of small properties; arrangement, plant use for the beautification of home surroundings. Lab. 4 cr.

535. HISTORY AND USE OF CULTIVATED PLANTS
Importance of cultivated plants in various civilizations. Use of plant or plant-derived products in early and contemporary societies. Lab. 4 cr.

566. TURF MANAGEMENT
Adaptation and management of fine turf grasses for recreational, aesthetic, and functional use. Lab. 4 cr.

604. PRINCIPLES OF GENETICS
Chemical and physical bases of inheritance; genes and chromosomes as units of mutation; genes in populations. Prereq: basic laboratory course in biological sciences. Organic chemistry; college math or statistics suggested. (Equivalent to Zool 604.) 4 cr.

606. PLANT PHYSIOLOGY
Structure and function in higher plants; water relations, metabolism, and growth and development. Prereq: Bot 411 or 503 or PlSc 421; one year of chemistry; /or permission. Lab. (Equivalent to Bot 606.) 4 cr.

607. WEED SCIENCE
Identification of weeds, their biological characteristics, and principles of control in all areas of plant science. Prereq: PlSc 421 or Bot 412. Lab. 4 cr.

651. FRUIT CROPS
Tree fruits and small fruits of the temperate zone: culture, management, and marketing for the small enterprise. Lab. 4 cr.

652. VEGETABLE CROPS
A discussion of technology and systems for producing and marketing vegetables locally and nationally, and a study of characteristics of specific crops and of their response to environment. Prereq: PlSc 421 and 522 or equivalent. 4 cr.

653. FORAGE CROPS
Selection, establishment, and management of crops grown for livestock utilization; field-oriented lab. Prereq: PlSc 421 or Bot 411 or permission. Lab. 4 cr.

654. CEREAL CROPS
Management practices related to the production and utilization of the world's grain crops. A term project is required. Prereq: PlSc 421 or Bot 412, or permission. 4 cr. (Not offered every year.)

672. PLANT PROPAGATION
Sexual and asexual propagation of horticultural plants. Plant science majors only. Lab. 4 cr.

678. ORNAMENTAL PLANTS
Their identification, culture, and use. Prereq: Bot 566 or equivalent. Lab. 4 cr.

705. POPULATION GENETICS
Population growth and regulation; genetic variation; factors affecting gene frequency; ecological genetics. Prereq: principles of genetics or permission. 4 cr. (Not offered every year.)

708. PLANT NUTRITION
Nutritional aspects of higher plants; uptake and assimilation, metabolic roles and growth response. Fertilizers: sources, manufacture, application, and energy dependence. Prereq: chemistry. Lab. 4 cr. (Not offered every year.)

711. STATISTICAL METHODS II
Intermediate course; basic concepts of sampling, linear models, and analyses for one-way and multiway classification, factorial arrangement of treatments, multiple regression, and covariance. Computer programs used in analyzing data. Examples from environmental sciences. Prereq: INER 528 or equivalent. Also offered as INER 711. 4 cr.

720. LABORATORY TECHNIQUES IN PLANT SCIENCES
Use of laboratory instruments and techniques including extraction procedures, spectrophotometry, fluorometry, electrophoresis, chromatography, atomic absorption spectrometer, measurement of respiration and photosynthesis, photography, use of microscopes, and use of instruments for monitoring the environment. Prereq: chemistry (three semesters) or permission. 3 cr. Cr/F.

740. EVOLUTIONARY BIOLOGY
Origin of life; source of genetic variation, population structure, mechanisms of evolution; molecular evolution; ecological adaptation in animals, plants, and man; community structure and evolution. Prereq: principles of genetics or permission. 4 cr. (Not offered every year.)

750. TOPICS IN AGRICULTURAL APPLICATIONS OF STATISTICS AND COMPUTING
A) Current Applications of Computers in Agriculture; B) Development of Computer Applications in Agriculture; C) Simulation of Crop Development; D) Agricultural Systems; E) Techniques for Field Experiments. Two-credit, 7-week modules offered in the middle of the spring semester. Consult plant science department for current offering. Prereq: permission. 2-10 cr.

762. PLANT METABOLISM
Function, occurrence, synthesis and degradation of plant constituents; respiration and photosynthesis; metabolism of nitrogenous and aromatic compounds; biochemical mechanisms in seed dormancy, fruit ripening, and disease resistance. Prereq: Bchm 601 or 751. 2 cr. (Not offered every year.)

773. METHODS AND THEORY OF PLANT BREEDING
Plant breeding systems for qualitative and quantitative plant improvement. Prereq: PlSc or Zool 604; INER 528; /or permission. 3 cr. (Not offered every year.)

776. RADIOISOTOPE TECHNIQUES FOR LIFE SCIENCE
Application of radioisotopes to biological systems; characteristics, detection, measurement, and tissue distribution of radioisotopes. Prereq: chemistry. Lab. 4 cr.

795, 796. ADVANCED TOPICS IN PLANT SCIENCE
Independent research, study, or group discussion. A) Physiology; B) Genetics; C) Plant Utilization; D) Microscopy. Prereq: permission. 2 or 4 cr.

Political Science (Polt)

(For program description, see page 32)

CHAIRPERSON: David L. Larson
PROFESSORS: Robert B. Dishman, Bernard K. Gordon, George K. Romoser
ASSOCIATE PROFESSORS: Warren R. Brown, Robert E. Craig, John R. Kayser, David L. Larson, David W. Moore, Lawrence W. O'Connell, B. Thomas Trout, Susan O. White
ASSISTANT PROFESSORS: Joseph P. Ford, Clifford J. Wirth
FACULTY IN RESIDENCE: Yves Eudes, Richard A. Kagan

Introductory Courses

400. CONTEMPORARY POLITICS
Examination of varying domestic and international political issues, such as censorship, electoral reform, terrorism, international security, corruption, and environmental pollution. 4 cr.

401. POLITICS AND SOCIETY
Introduction to nature of politics and political institutions. Emphasis on political behavior and continuing issues of modern politics, such as power, authority, legitimacy, freedom and order. 4 cr.

402. AMERICAN GOVERNMENT AND POLITICS
Institutions and processes of national government in the United States, and political culture of the American people. Structure of national government; role of general public in government; cultural influences on American politics. 4 cr.

403. UNITED STATES IN WORLD AFFAIRS
Major issues in world affairs since 1945 as they relate to United States foreign policy: U.S.-Soviet relations, third-world politics, regional and alliance politics, weapons technology and resource depletion, economic development and population control. 4 cr.

595, 596. EXPLORATIONS IN POLITICS
Designed to meet special interests of students and instructors in exploring selected issues in political science. See departmental listings for semester offerings. 2-4 cr.

American Politics

500. AMERICAN PUBLIC POLICY
Political and economic factors which mold the processes by which American policymakers deal with such domestic issues as crime and violence, poverty and inequality, inflation and unemployment, urban blight and renewal, and energy and the environment. 4 cr.

502. STATE GOVERNMENT AND FEDERALISM
Powers, politics, and constitutional setting of American state governments: state legislatures, governorships, party systems, and interest groups, taxation, welfare, environment, and education, 4 cr.

503. LOCAL GOVERNMENT AND POLITICS
Structure, politics, and legal setting of American local government, including towns, cities, counties, and special districts. Community power and decision making, town meetings and such issues as home rule, zoning, and the property tax. 4 cr.

504. AMERICAN PRESIDENCY
Role and powers of the presidency in domestic and foreign affairs. The president as administrator, policymaker, and political leader. Executive-congressional relations. 4 cr.

505. AMERICAN CONGRESS
Role and powers of congress as national lawmaker and check on the executive branch: committee structure, concepts of representation, legislative oversight, and party cleavage, federal budget control and foreign policy involvement. 4 cr.

506. PARTIES, INTEREST GROUPS, AND VOTERS
Role of political parties as organizers and managers of social conflict. Role of voters in controlling parties and government. Influence of interest groups in the electoral process and in governmental decision making. 4 cr.

507. POLITICS OF CRIME AND JUSTICE
Criminal justice in theory and practice; contemporary role of police, prosecutors, judges, juries, counsel, and interest groups in the administration of criminal justice. 4 cr.

508. SUPREME COURT AND THE CONSTITUTION
Supreme court treated as a political institution whose historic mission is to decide all controversies arising under the constitution between the nation and the states, the president and congress, governments generally and the people as to their respective rights and duties. 4 cr.

509. BUREAUCRACY IN AMERICA
Growth and development of the bureaucratic state. Roles and powers of administrative officials, decision making in bureaucratic settings, citizen participation, and the influence of interest groups on bureaucratic policy making. 4 cr.

510. MASS MEDIA IN AMERICAN POLITICS
Contemporary review of media in politics; major roles of media today in providing news, setting public agenda, influencing public opinion; government regulation vs. media responsibility; future developments and consequences for American democracy. 4 cr.

511. MARINE POLICY
Legal and policy aspects of coastal zone, continental shelf, and ocean resource management including fish, oil, gas, pollution, offshore installations, and the deep seabed. 4 cr.

512. PUBLIC OPINION IN AMERICAN POLITICS
Relationship of mass and elite opinion within the context of American political culture. Impact of public opinion on American governmental policies, especially with respect to major issues facing the president and congress. Appraisal of responsiveness to influence and responsibility to lead. 4 cr.

513. CIVIL RIGHTS AND LIBERTIES
Analysis of three major areas of constitutional rights and liberties—political freedom, equal protection of the laws, and due process—with particular attention to their impact on such problems as political protest, discrimination, school segregation and busing, and student rights. 4 cr.

600. SELECTED TOPICS IN AMERICAN POLITICS
Special topics such as politics and public affairs in New Hampshire, the press and the media in America, women in politics, and civil liberities. See department listings for semester offerings. 4 cr.

601. ELECTION PRACTICUM
Field work in political campaigns combined with analysis of the electoral process. Prereq: permission. 4 cr. (Not offered every year.)

701. THE COURTS AND PUBLIC POLICY
Impact of judicial decisions on public policy at federal, state, local, and regional levels. 4 cr.

702. PUBLIC PLANNING AND BUDGETING
Analysis, goal setting, and strategic planning in a governmental setting, with particular emphasis on budgetary processes as a means for controlling policy effectiveness. 4 cr.

703. URBAN AND METROPOLITAN POLITICS
Planning and management of the urban community, intergovernment relations, administrative functions, and general urban problems. 4 cr.

704. POLICY AND PROGRAM EVALUATION
Policy and program evaluation of federal, state, and local governmental enterprise; focuses on the politics, practices, and methods of evaluative investigation. Evaluation as a technique for providing rational information for budgetary and policymaking decisions. 4 cr.

797, 798. SECTION B: SEMINAR IN AMERICAN POLITICS
Advanced analysis and individual research. Prereq: senior or graduate standing. 4 cr.

797, 798. SECTION F: SEMINAR IN PUBLIC ADMINISTRATION
Advanced analysis and individual research, including opportunities for direct observation of governmental administration. Prereq: senior or graduate standing. 4 cr.

Comparative Politics

544. DICTATORSHIP AND TOTALITARIANISM
Political systems of Nazi Germany, Fascist Italy, Stalinist Russia, and Maoist China; the movements which gave rise to them and their significance for understanding political behavior. 4 cr.

552. CONTEMPORARY EUROPEAN POLITICS
Politics and governments in Western Europe, with attention to both basic characteristics of political life in different countries and current issues of politics. 4 cr.

553. DEVELOPING NATIONS
Politics in selected developing states in Africa, Latin America, Asia, and the Middle East. Issues and concepts of political change. 4 cr.

555. POLITICS IN THE USSR
Background, structure, leadership, and underlying issues of the Soviet political system. Ideological bases, political history, and contemporary trends. 4 cr.

556. POLITICS IN CHINA
Historical development, structure, ideological bases, and underlying contemporary issues of the

Chinese political system; influence of ideology and the role of Maoism. 4 cr.

557. POLITICS IN JAPAN AND SOUTHEAST ASIA
Major noncommunist governments in East Asia; parties and policy making in Japan and other states such as Malaysia, Thailand, Indonesia, and the Philippines. 4 cr.

651. SELECTED TOPICS IN COMPARATIVE POLITICS
Specialized areas on issues such as regional politics, national politics, judicial systems, administrative law, constitutions, etc. See department listing for semester offerings. 4 cr.

741. POLITICS OF INDUSTRIALIZED STATES
Impact of modern industrialism and its organization upon political life, social structure, and the conduct of government. 4 cr.

742. COMMUNIST SYSTEMS
Interests, demands, and decision making in communist governments. Ideological issues, political behavior within communist international organizations, intraparty relations, distinctions between ruling and nonruling communist parties. 4 cr.

797, 798. SECTION C: SEMINAR IN COMPARATIVE POLITICS
Advanced analysis and individual research on foreign nations or regions, focusing on governmental institutions, foreign policy, political parties, or bureaucracy. Prereq: senior or graduate standing. 4 cr.

International Politics

560. WORLD POLITICS
Issues and structures which shape contemporary international politics, including rise of the nation-state system, conflict and its resolution, and problems of national interest and choice between nations. 4 cr.

561. AMERICAN FOREIGN POLICY
Constitutional, institutional, political, and societal factors that influence the formulation and execution of U.S. foreign policy. 4 cr.

562. STRATEGY AND NATIONAL SECURITY POLICY
Defense and deterrence among the major powers, including the impact of modern weapons on war and arms limitations, the military as a profession, and the role of the armed forces in shaping defense policy. 4 cr.

563. FOREIGN POLICIES OF EUROPE
East-West relations, security alliances, economics and political cooperation, and impact of domestic changes and superpower relationships upon the international politics of Europe. 4 cr.

564. SOVIET FOREIGN POLICY
Background and contemporary perspectives of the Soviet role in international politics. Particular emphasis on issues in international communism, Soviet-American relations, Soviet arms development, and Sino-Soviet relations. 4 cr.

565. FOREIGN POLICIES OF ASIA AND THE PACIFIC
Current foreign and defense policies as they affect the Pacific region. International politics of China, Japan, and selected Southeast Asian nations, including their efforts at cooperation. 4 cr.

660. SELECTED TOPICS IN INTERNATIONAL POLITICS
Specialized areas or issues in international relations such as conflict resolution and disarmament, European perspectives on American politics, contemporary diplomatic practices, seapower and defense. 4 cr.

760. THEORIES OF INTERNATIONAL POLITICS AND INTEGRATION
General explanations of the behavior of nations; theory and practice of supra-national integration; theories of peace and security and community building at the international level; concepts and experience in arms limitations and conflict resolution. 4 cr.

761. INTERNATIONAL LAW
Formalized processes for regularizing state behavior; development of norms based on custom, precedent, and formal institutions, as in treaties and cases. Arms reduction and limitation arrangements; inspection, and other formal procedures designed to preserve peace. 4 cr.

778. INTERNATIONAL ORGANIZATION
Collective security and other forms of cooperation among nations through international organizations such as the United Nations and its predecessors, and through regional bodies. 4 cr.

797, 798. SECTION E: SEMINAR IN INTERNATIONAL POLITICS
Advanced analysis and individual research; emphasis on developments in theory. Prereq: senior or graduate standing. 4 cr.

Political Thought

520. JUSTICE AND THE POLITICAL COMMUNITY
Origin of the idea of justice, relationship between politics, justice, and morality; selections from Plato, Aristotle, and Roman, Islamic, and Christian political philosophers. 4 cr.

521. RIGHTS AND THE POLITICAL COMMUNITY
Human rights and the quality of communities as expressed in Hobbes, Locke, Mandeville, Rousseau, and others. 4 cr.

522. DISSENT AND THE POLITICAL COMMUNITY
Current political ideologies and controversies in America and abroad; liberal democracy and its critics since the 19th century. 4 cr.

523. AMERICAN POLITICAL THOUGHT
American political thinkers and observers of American politics; the founding of the Republic; problems and tensions reflected in the writings of Calhoun, Thoreau, Lincoln, de Tocqueville, and others; relations between liberty and authority, democracy and stability, capitalism and alienation. 4 cr.

524. POLITICS AND LITERATURE
Classical and contemporary works of literature to illustrate perennial issues in political philosophy; among authors studied are Aristophanes, Sophocles, Shakespeare, Melville, Tolstoy, and Sartre. 4 cr.

620. SELECTED TOPICS IN POLITICAL THOUGHT
Selected issues in political theory, such as liberalism and conservatism, radical political thought, the American political character, and others. See department listings for semester offerings. 4 cr.

720. PERSPECTIVES ON POLITICAL SCIENCE
Different views on the study and meaning of politics. Perspectives of political scientists, political philosophers, and political activists. 4 cr.

721. POLITICS AND ECONOMICS: POLITICAL ECONOMY AND THE MODERN STATE
The modern state and issues of political economy. This relationship will be covered by treatments of Adam Smith, David Ricardo, Karl Marx, Max Weber, John Maynard Keynes, and Joseph Schumpeter. In the final stages of course, issues of "supply-side" economics, private and public planning priorities, and current criticism of the welfare state will be discussed. 4 cr.

797, 798. SECTION I: SEMINAR IN POLITICAL THOUGHT
Advanced treatment and individual research. Prereq: senior or graduate standing. 4 cr.

Internships, Advanced Studies, and Honors Thesis

602. INTERNSHIP IN POLITICAL SCIENCE
Field experience in a governmental or non-governmental organization at the local, state, national, or international level. Arrangements should be made through the political science department. Open to juniors or seniors with at least a 3.00 GPA. Permission of the Undergraduate Program committee of the Department is required prior to the internship. From 4 to 16 credits may be taken; however, only four credits may be for grade. The rest will be credit/fail, and only four credits may be applied to the political science major. (May be taken in conjunction with Advanced Study in Politics (Political Science).

795, 796. ADVANCED STUDY IN POLITICAL SCIENCE
Senior students, majoring in Political Science, with a cumulative average of 3.20 or greater, may undertake advanced study (Political Science), in an area of their choice, in consultation with member(s) of the faculty. Normally, the result of the project will be a significant written product of a quality comparable to that done at the 700 course level. Students must initiate the project discussion and obtain approval of the Undergraduate Program Committee of the Department prior to undertaking the project. The advanced study project will constitute the tenth course in the major, and the Department will recognize the completion of advanced study by recognizing the student as having completed the major "with distinction." 4 cr.

799. HONORS THESIS
Senior students, majoring in political science, with a cumulative average of 3.50 or greater, and an average in their majors of 3.67 or greater, may undertake a special honors project in an area of their choice. The results of this special project will be a significant written product constituting an honors thesis, under the supervision of a faculty sponsor. Students must initiate the project discussion and obtain the approval of the Undergraduate Program Committee prior to undertaking the project. The honors thesis will constitute the tenth course in the major and will earn the student an official recognition as having completed an Honors Program in Political Science. 4 cr.

Portuguese

(See Ancient and Modern Languages and Literatures: Spanish)

Psychology (Psyc)

(For program description, see page 33)

CHAIRPERSON: John A. Nevin
PROFESSORS: Raymond L. Erickson, Gordon A. Haaland, John A. Nevin
ASSOCIATE PROFESSORS: William M. Baum, Victor A. Benassi, James R. Davis, Peter S. Fernald, Earl C. Hagstrom, David E. Leary, John E. Limber, Daniel C. Williams, William R. Woodward
ASSISTANT PROFESSORS: Ellen S. Cohn, Kenneth Fuld, Carolyn J. Mebert, Anne W. Sandoval, Rebecca M. Warner
INSTRUCTOR: Esther Goldminz
RESEARCH ASSOCIATE PROFESSOR: Robert A. Smith
LECTURERS: Stephen Seeman, Sarah Stram, David Sugarman

The listings that follow are general descriptions of the courses. Students are referred to the Instructors' Course Descriptions published by the department each semester for specific details about each section. Listings will be made available in departmental offices before and during the preregistration period.

Psychology 401 is a prerequisite for all courses in the psychology department except psychology 491, 571, 572, and 770.

Psychology 402 is a prerequisite for all 700-level psychology courses except 770 and 771.

General Courses

401. INTRODUCTION TO PSYCHOLOGY
Psychology as a behavioral science; its theoretical and applied aspects. Coverage of basic topics in the field, including developmental, learning, personality, abnormal, social, perceptual/sensory, and physiological psychology. To actively experience the nature of psychological research, students have an opportunity to participate in a variety of studies as part of a laboratory experience. 4 cr.

461. CLINICAL APPROACHES TO HUMAN BEHAVIOR
Normal and abnormal behavior from the viewpoints of Freud, Rogers, learning theorists, existentialists, and others. Human behavior; clinical procedures of evaluating and modifying behavior.

Nature of the clinical approach; no clinical training. Prereq: Psyc 401. 4 cr.

491. GENERAL TOPICS IN PSYCHOLOGY
New courses of general interest and focus are presented under this listing. Staff present material not normally covered in regular course offerings. May repeat but not duplicate areas. Not for major credit. 4 cr.

Major Courses

402. STATISTICS IN PSYCHOLOGY
Design, statistical analysis, and decision making in psychological research. Substantive problems as illustrations of typical applications and underlying logic. Prereq: Psyc 401. 4 cr.

502. RESEARCH METHODS IN PSYCHOLOGY
Research design, including experimental and correlation design; internal versus external validity; measurement; writing a research report; graphic and statistical methods for summarizing data; sampling; and special problems such as experimenter effects, reactivity of measurement, and others. the use of hypothesis testing and data analysis in research. Prereq: Psyc 401 and 402. 4 cr.

511. INTRODUCTION TO PERCEPTION, LANGUAGE, AND THOUGHT
Human mental processes. Visual and auditory perception; language; attention; memory; thinking; problem solving; creativity. Interrelationships among these areas of human psychology. Prereq: Psyc 401. 4 cr.

512. PSYCHOLOGY OF PRIMATES
A comparative analysis of primate cognitive, linguistic, and social processes. The origins of human behavior will be explored from the perspectives of history, evolution, and contemporary work in neuropsychology, linguistics, sociobiology, and related fields. Prereq: Psyc 401. 4 cr.

521. PRINCIPLES OF LEARNING AND THEIR APPLICATION
Principles developed from experimental study of human and animal learning; their theoretical integration; their application to the understanding of human behavior. Procedures for changing behavior in practical situations, related to theories of learning. Prereq: Psyc 401. 4 cr.

522. BEHAVIORISM
Introduction to behaviorism as a philosophy of science. Some historical background, but concentration on modern behaviorism as exemplified in the works of B.F. Skinner. Prereq: Psyc 401. 4 cr.

531. PSYCHOBIOLOGY
The human as a biological machine; advantages and limits of such an approach for studying behavior. Perception, language, and thought; learning and memory; emotions from the point of view of physiology. Prereq: Psyc 401. 4 cr.

551. PSYCHOLOGY OF SEX ROLES
The psychology of women and men, and sex-role differences in socialization, personality, achievement motivation, altruism, aggression, power, etc. Prereq: Psyc 401. 4 cr.

552. SOCIAL PSYCHOLOGY
Behavior of individuals as affected by other individuals, groups, and society. Topics include attitude change and social influence, conformity, social interaction, interpersonal attraction, impression formation, research. Prereq: Psyc 401. 4 cr.

553. PERSONALITY
Major theories, methods of assessment, and research. Prereq: Psyc 401. 4 cr.

571. THE GREAT PSYCHOLOGISTS
Historical introduction to some of the great psychologists and their classic works. 4 cr.

572. WILLIAM JAMES: THE HUMANIST AS PSYCHOLOGIST
Study of the life, concerns, and work of one of the major founders of modern scientific psychology, along with analyses of the still very relevant issues raised in and by his psychology (or by any psychology) that rests upon both humanistic and scientific foundations. 4 cr.

581. CHILD DEVELOPMENT
The developing child in the context of his/her society. Current problems in and influences on development of the child. Personality and cognitive development; exceptional children. Prereq: Psyc 401. 4 cr.

582. ADULT DEVELOPMENT
Personality, social, cognitive development of the adult within society. Prereq: Psyc 401. 4 cr.

702. ADVANCED STATISTICS AND RESEARCH METHODOLOGY
Experimental design, analysis, and interpretation. Repeated measures, designs, trend analyses, nonparametric analyses, confounding, missing data, interpretation of interactions, and computer processing of data. Intended primarily for majors planning to attend graduate school. Prereq: Psyc 402; 502; /or permission. 4 cr. (Not offered every year.)

703. EXPERIMENTAL PSYCHOLOGY
Experimental methods applied to psychological processes; principles of experimental design; methods of data analysis. Each student responsible for an original experiment. Prereq: Psyc 402; 502; /or permission. 5 cr.

704. RESEARCH METHODS IN SOCIAL PSYCHOLOGY
Features, assets, liabilities, and appropriate applications of measurement, survey methods, field and laboratory experiments, and non-reactive methods. Philosophy of science, ethical responsibility, and artifact in research. Each student responsible for an original research project. Prereq: Psyc 402; 502; 552; /or permission. 4 cr.

705. TESTS AND MEASUREMENT
Testing intelligence, creativity, achievement, interests, and personality. Test construction; evaluation; relation to psychological theory, research, and practice. Prereq: Psyc 402; 502; /or permission. 4 cr.

710. PSYCHOLOGY OF VISUAL PERCEPTION
Anatomy, physiology, psychophysics, and perceptual processes of vision. Topics include physics of

light, psychophysics, color, space and form, depth, motion, eye movements, visual learning and development, constancy, and illusions. Prereq: Psyc 402; 511; /or permission. 4 cr.

711. SENSATION AND PERCEPTION
Anatomy, physiology, psychophysics, and perceptual processes of the visual, auditory, gustatory, olfactory, and cutaneous senses. Topics include stimulus definition, psychophysics, sensory transduction, sensory and perceptual adaptation, neural coding of space, time, magnitude, and quality. Prereq: Psyc 402; 511; /or permission. 4 cr.

712. PSYCHOLOGY OF LANGUAGE
Theories of language structure; functions of human language; meaning; relationship of language to other mental processes; language acquisition; indices of language development; speech perception; reading. Prereq: Psyc 402; 511; /or permission. 4 cr.

713. COGNITION
Complex mental activities; consciousness and attention; concept formation; reasoning; problem solving; creative thinking; relationship between cognition and affective behavior. Prereq: Psyc 402; 511; /or permission. 4 cr.

721. THE EXPERIMENTAL ANALYSIS OF BEHAVIOR
Environmental and biological determiners of behavior. Theory, research methods, and applications. Major concepts and recent research. Prereq: Psyc 402; 521 /or permission. 4 cr.

722. HUMAN LEARNING
Experimental study of human learning and retention. Memory, transfer, verbal learning, perceptual learning, concept learning, and observational learning. Methodologies typical of research in these areas. Prereq: Psyc 402; 521 or 703; /or permission. 4 cr.

723. APPLIED BEHAVIORAL ANALYSIS
Applications of learning theory to the solution of socially relevant problems. Appreciation of current research and theory in the field of applied behavior analysis. Prereq: Psyc 402; 521 or 703; /or permission. 4 cr.

731. BRAIN AND BEHAVIOR
Relationships between the nervous system and behavior. Physiological, neural, and biochemical mechanisms underlying instinct, memory, learning, emotion, and consciousness in humans; evolution of these functions in lower animals. Prereq: Psyc 402; 531; /or permission. 4 cr.

732. COMPARATIVE PSYCHOLOGY
Comparisons of the basic processes of sensation, motivation, learning, and social behavior in different species. Contemporary theories of behavior formulated by ethologists and ecologists contrasted and compared with current theories in psychology. Prereq: Psyc 402; 521; /or permission. 4 cr.

752. ADVANCED SOCIAL PSYCHOLOGY
A general survey of current research and major theories. An in-depth critical analysis of selected topics such as attribution theory, social cognition, and theories of aggression. Prereq: Psyc 402; 552; /or permission. 4 cr.

755. SOCIAL PSYCHOLOGY OF SOCIAL ISSUES
Crime, violence in the family, aging, television, health, politics, and behavior of men and women. Specific social psychological processes applied to the nature and solution of each problem. Prereq: Psyc 402; 552 /or permission. 4 cr.

756. ENVIRONMENTAL PSYCHOLOGY
Human behavior as influenced by the natural and personmade physical environment. Coverage of research and theory on such topics as privacy, territoriality, crowding, personal space, urban stress, behaviorally-based design, paralinguistics, and behavior in natural settings. Prereq: Psyc 402; 552; /or permission. 4 cr.

761. ABNORMAL BEHAVIOR
Disturbing behaviors; historical developments; viewpoints of etiology; identifying and understanding disruptive behavior; diagnostic implications for treatment as a function of varying theoretical viewpoints. Prereq: Psyc 402; 553; /or permission. 4 cr.

762. COUNSELING
Theories of counseling; ethical considerations; professional and paraprofessional activities in a variety of work settings. Prereq: Psyc 402; 553 or 461; /or permission. 4 cr.

770. HISTORY OF PSYCHOLOGY
Survey of the history of psychology up to the 20th century. Major figures, theories, and developments. Relationship to developments in cultural history, philosophy, and the natural sciences. Beginnings of modern scientific psychology. 4 cr.

771. SURVEY OF 20TH CENTURY PSYCHOLOGY
Reassesses, extends, and integrates knowledge of 20th century psychology within historical perspective. Major figures, schools, systems, theories. Review of major fields of psychology. Useful as preparation for the Graduate Record Examination. Prereq: Psyc 401. 4 cr.

781. DEVELOPMENTAL PSYCHOLOGY
Current research and major theories; cognitive, personality, learning, and emotional development. Prereq: 402; 581 or 582 or FCS 525; /or permission. 4 cr.

783. DEVELOPMENTAL PSYCHOPATHOLOGY
Major issues in psychopathology from a developmental perspective. Emphasis on theories of etiology, approaches to treatment, and research issues in a variety of atypical populations. Diagnostic classification schemes, rights of children, and methods of assessment. Prereq: Psyc 402; 581; /or permission. 4 cr.

Special Courses

591. SPECIAL TOPICS IN PSYCHOLOGY
New or specialized courses are presented under this listing. Staff present material not normally covered in regular course offerings. May repeat but not duplicate areas. Prereq: Psyc 401. 4 cr.

791. ADVANCED TOPICS
Advanced material in which instructor has specialized knowledge through research and study. May

repeat but not duplicate areas. Prereq: Psyc 402 or permission. 4 cr.

793. EXTERNSHIP
Supervised practicum in one of several cooperating New Hampshire mental health/rehabilitation facilities. Coursework knowledge applied to meaningful work and team experience. Commitment includes a negotiated number of weekly work hours and weekly seminars. Supervision by institution personnel and the instructor. Course applications accepted beginning in March for fall term and October for spring term. Prereq: permission; Psyc major; Psyc 402; additional psychology courses desirable. A maximum of 4 credits of 793, 794, and 795 can count toward the minimum of 36 credits for Psyc major. Up to 8 cr.

794. ADVANCED EXTERNSHIP
Supervised advanced practicum experience in cooperating New Hampshire mental health/rehabilitation facilities. Expands and builds on experiences and skills acquired in Psyc 793. Commitment includes a negotiated number of hours of work per week and participation in weekly seminars. Supervision done by institution personnel and instructor. Course applications accepted beginning in October for spring term. Prereq: Psyc 793; permission. Maximum of four credits of 793, 794, and 795 can count toward the minimum of 36 credits for Psyc major. Up to 8 cr. (Offered spring semester only.)

795. INDEPENDENT STUDY
A) Physiological; B) Perception; C) History and Theory; D) Learning; E) Social; F) Cognition; G) Statistics and Methods; H) Experimental; I) Personality; J) Developmental; K) Counseling; L) Psychotherapy; M) Research Apprenticeship; N) Teaching of Psychology (content area to be determined). Specific independent study opportunities are sometimes posted in the psychology offices. Arrangements to be made with a specific faculty member; enrollment by permission only. A maximum of 4 credits of 793, 794, and 795 can count toward the minimum of 36 credits for Psyc major. 1-4 cr.

Recreation and Parks (RecP)

(For program description, see page 73)

CHAIRPERSON: Gus C. Zaso
ASSOCIATE PROFESSOR: Gus C. Zaso
ASSISTANT PROFESSORS: Ann L. Morgan, Lou G. Powell
LECTURER: Jeffrey P. Witman
ADJUNCT PROFESSOR: Wilbur F. LaPage
ADJUNCT ASSOCIATE PROFESSOR: Herbert L. Echelberger

400. IMPACT OF LEISURE
Issues which contribute to the emergence of a leisure-oriented society and significant problems which accompany the expansion of leisure opportunities. 4 cr.

454. SPECIAL FACILITY OPERATIONS
Management of public, private, and commerical recreation facilities. 4 cr.

455. INTRODUCTION TO RECREATION AND PARK SERVICES
Role of recreation and parks in contemporary society. 4 cr.

501. LEISURE SERVICES FOR THE HANDICAPPED
Practical aspects of leisure service delivery for handicapped individuals who are in the mainstream of society. 4 cr.

502. INTRODUCTION TO THERAPEUTIC RECREATION
History and professional concepts of therapeutic recreation and the roles and functions of the therapeutic recreator. 4 cr.

543. COMPARATIVE ENVIRONMENTAL EDUCATION
Interdependent environmental analyses with application to recreational and educational situations. 4 cr.

544. OUTDOOR EDUCATION
Elements of programming as they relate to the school curriculum and school camping. 4 cr.

557. INTRODUCTION TO LEADERSHIP AND PROGRAMMING
Leadership theories, methods, and processes and their relationship to principles of program planning and organization. Lectures, discussions, and volunteer experiences. 4 cr.

558. RECREATION PROGRAM DEVELOPMENT
Intensive study of the recreation program areas available to participants; analysis of the methods and techniques of needs assessment; program implementation and program evaluation. Lecture, presentations, practicum experiences. 4 cr.

560. CAMPUS RECREATION SERVICES
Management of college unions and campus recreation resources in higher education. 4 cr.

561. INTRODUCTION TO OUTDOOR RECREATION
The history, delivery system, social and economic impacts, and management tools for outdoor recreation. Includes identification of contemporary issues, problems, and opportunities in recreation resource management. Lab. 4 cr.

593. SPECIAL TOPICS
A) Camping and Outdoor Education for the Handicapped; B) Techniques in Therapeutic Recreation; C) Tourism and Leisure. Specialized courses covering information not presented in regular course offerings. Description of topics available in department office during preregistration. Prereq: RecP 455. May be repeated but not in duplicate areas. 4 cr.

661. RECREATION RESOURCES MANAGEMENT
Park practices as they relate to location, management, and maintenance. 4 cr.

663. RECREATION AND PARK ADMINISTRATION
Theoretical and practical methods used in attaining organizational goals. 4 cr.

664. FIELD WORK
Supervised experience in approved leisure/recreational/health service or related agency. Prereq: RecP major and permission. An "IA" grade (year-long course) may be assigned at the end of the first semester or summer session. 4-8 cr. Cr/F.

667. RECREATION AND RESOURCE PLANNING
Master planning concepts which relate to public systems. 4 cr.

772. LEGAL AND FINANCIAL ASPECTS OF DELIVERY SYSTEMS
A review of the basic legal and financial aspects of leisure-oriented and other human resource services; special attention to establishing systems and departments, powers, operations, federal regulations, tort liabilities, and technical assistance programs. 4 cr.

793. ADVANCED TOPICS
A) Area and Site Planning. Topics presented by instructors with specialized knowledge gained through professional practice, research, and study. Description of topics available in department office during preregistration. May be repeated but not in duplicate areas. 4 cr.

796. INDEPENDENT STUDY
Individual study and/or research relating to leisure-oriented topics. 1-4 cr.

798. SEMINAR IN LEISURE
Reviews of problems, trends, and current practices. 4 cr.

Religious Studies (RS)

(For program description, see page 24)

COORDINATOR: John O. Voll

501. CONTEMPORARY APPROACHES TO THE STUDY OF RELIGION
A variety of contemporary methods for studying religion, as well as an analysis of such significant cross-cultural continuities in various religious traditions as mythology, ritual, canon, etc. 4 cr.

599. SPECIAL TOPICS
Studies of particular religious traditions, or periods within those traditions, or special topics and issues of concern within religious studies such as mythology, ritual, mysticism, etc. 4 cr.

695, 696. INDEPENDENT STUDY
Independent study of traditions, topics, or figures within the scope of religious studies. Before registration, student must formulate a project and secure consent of a cooperating department faculty member who will supervise the independent study. 2 or 4 cr.

699. SENIOR SEMINAR
A capstone experience intended to help students draw together their various studies in the field of religion. Prereq: any two courses in religious studies or permission. 4 cr.

Reserve Officers Training Corps

(For program description, see page 82)

(See Aerospace Studies and Military Science)

Resource Economics

(For program description, see page 45)

(See Institute of Natural and Environmental Resources)

Russian

(See Ancient and Modern Languages and Literatures)

School of Health Studies (SHS)

(For program description, see page 67)

400. HEALTH-HUMAN VALUES
Physiological, emotional, social, and environmental factors affecting health. Basic health information to broaden understanding of health-related issues. Students examine their patterns of decision making in issues directly affecting their lives. Also offered as OT 400. 4 cr.

798. SPECIAL TOPICS IN HEALTH STUDIES
Students may explore areas related to specific professional health interests. May repeat but not duplicate subject areas. A) Communication Disorders; B) Health Administration and Planning; C) Medical Technology; D) Nursing; E) Occupational Therapy; F) Physical Education; G) Recreation and Parks; K) Survey of Therapeutic Approaches to Developmental Disabilities (interdisciplinary); H-J and I-Z) Interdisciplinary. Prereq: permission. 1-4 cr.

Secretarial Studies (Secr)

(For program description, see page 78)

ASSOCIATE PROFESSOR: Myra L. Davis

401-402. SHORTHAND
Principles of Gregg shorthand followed by dictation and transcription. Prereq: proficiency in typing or Secr 405 or 407 taken concurrently. 4 cr.

405. PERSONAL USE TYPEWRITING
Practice in acquiring correct typewriting techniques, and in arranging letters and manuscripts. Open to students who do not know how to type. 2 cr. Cr/F.

407-408. TYPEWRITING
Beginning course, primarily for students interested in two semesters. 2 cr.

427. TYPEWRITING
To be taken instead of Secr 407 by students who have had a personal-use typewriting course. Class begins at midsemester. 1 cr.

Social Science (ScSc)

Coordinators for the Social Science Division, College of Liberal Arts, are Barbara Coakley and John O. Voll.

681. INTERNSHIPS
Fieldwork in a state or local government department, agency, or institution, or in an approved private agency. Work will be under supervision of agency. Department chairperson or representative is responsible for arranging the program. Offered through Departments of History, Political Science, Psychology, Sociology and Anthropology, or the Whittemore School of Business and Economics. Prereq: senior standing. Variable to 16 cr.

682. WASHINGTON INTERNSHIP
Internship placements in Washington, D.C., through the Washington Center for Learning Alternatives (WCLA). Individual internships arranged in congressional offices, executive and federal agencies, and public interest and judicial agencies. Supervision by agency personnel and faculty sponsor. Open to all majors. Applications available in the Whittemore School dean's office, McConnell Hall. Prereq: second semester junior, or senior. Student must also register for a graded, 4-credit independent study in the student's major. Internship credit variable to 12 cr. Cr/F.

Social Service (S S)

(For program description, see page 33)

CHAIRPERSON: Betty Holroyd Roberts
ASSOCIATE PROFESSORS: Betty Holroyd Roberts, Pauline Soukaris
ASSISTANT PROFESSOR: Richard J. Kaufman
INSTRUCTORS: Philip Brown, Robert E. Jolley

524. INTRODUCTION TO SOCIAL WORK AND SOCIAL WELFARE
The role of social work within agency structures. Programs, policies, social work services studied in historical perspective; their auspices, goals, and operations for consumers from various ethnic, racial, and social groups. Weekly observational/participatory assignments at community agencies. 4 cr.

525. INTRODUCTION TO SOCIAL WELFARE POLICY: PROVISIONS
U.S. social welfare provisions: income, housing, employment, and health care. Program and policies in historical perspective: their auspices, goals, and operations for consumers from various social, racial, and ethnic groups. 4 cr.

550. HUMAN BEHAVIOR AND SOCIAL ENVIRONMENT I
Introduction to human behavior and development as it influences and is influenced by multiple factors in the social environment, including individual genetic and biological composition, race, gender, age, socio-economic status, ethnicity, geographic location, physical appearance, and ability. How these factors operate throughout the life cycle. Provides a knowledge base and perspective to understand a client's behavior, attitude, and values in relation to the attitudes and values of the social work professional and the larger society. 4 cr.

551. HUMAN BEHAVIOR AND SOCIAL ENVIRONMENT II
Continuation of 550. Agents of socialization that most significantly affect individual development and behavior, and a dynamic and changeable concept of social systems as they affect individual and group behavior in relation to the dominant society. Prereq: S S 550; major. 4 cr.

622. SOCIAL WORK PRACTICE I
Introduction to methods and practice. Basic principles, values, and ethics. Interviewing skills, problem assessment, social contracting. Skills training in lab sessions. Required for majors, should be taken in junior year. Prereq: S S 524 or permission. 4 cr.

623. SOCIAL WORK PRACTICE II
Continuation of S S 622. Delineation and study of intervention and change strategies differentiated with individuals, groups, and communities. Required for majors. Prereq: S S 622. 4 cr.

632. SPECIAL TOPICS IN SOCIAL WELFARE
Seminar for advanced majors. Topics may include income maintenance, alcoholism, health care, aging, child welfare, and mental health; to increase understanding of factors that influence program development and service delivery. 4 cr.

633. SEMINAR IN SOCIAL WORK METHODS
Analysis and comparison of change theories, intervention strategies, therapeutic techniques. Seminar format. Possible topics: techniques of group work, casework or community practice, behavior modification, and staff development and supervision. Prereq: senior major standing. 4 cr.

640. SOCIAL WELFARE FIELD EXPERIENCE: I
Majors will be placed in a social welfare setting for a minimum of 225 hours, concurrent with a weekly seminar on campus; individual arrangements with faculty coordinator. Required for majors. Prereq: S S 623 and permission. (No credit toward a minor.) 8 cr. Cr/F.

641. SOCIAL WELFARE FIELD EXPERIENCE: II
A continuation of S S 640. Required for majors. Prereq: S S 640 and permission. (No credit toward a minor.) 8 cr. Cr/F.

700. SOCIAL GERONTOLOGY
Theories, social problems, programmatic responses, and recent research on aging; emphasis on the psycho-social forces. Prereq: senior or graduate status; /or permission. 4 cr.

701. WOMEN AND AGING
An analysis of the major theories about the social conditioning of aging women and its effect in contemporary society. Human service response will be addressed. Psycho-social, biological, legal, and economic implications will be reviewed. Prereq: senior or graduate status or permission. 4 cr.

795, 796. READINGS AND RESEARCH IN SOCIAL SERVICE
Independent work under social service faculty guidance. Prereq: 12 hours of social service; permission. Variable 2, 4, or 6 cr. Cr/F.

Sociology and Anthropology

CHAIRPERSON: Arnold S. Linsky
PROFESSORS: Melvin T. Bobick, Walter F. Buckley, Bud B. Khleif, Arnold S. Linsky, Stuart Palmer, Solomon Poll, Murray A. Straus
ASSOCIATE PROFESSORS: Charles E. Bolian, Peter Dodge, Richard E. Downs, Melville Nielson, Stephen P. Reyna, Frederick Samuels, Howard M. Shapiro
ASSISTANT PROFESSORS: Lawrence C. Hamilton, Barbara K. Larson, Sally Ward, Deborah Winslow

Anthropology (Anth)

(For program description, see page 25)

411. CULTURAL AND SOCIAL ANTHROPOLOGY
Cultural and social aspects of human behavior, particularly in relation to nonindustrial societies. Analysis of selected societies, institutions, and forms of social structure. 4 cr.

412. PHYSICAL ANTHROPOLOGY AND PREHISTORIC ARCHAEOLOGY
Human physical evolution and cultural prehistory; evolutionary theory and archaeological techniques. 4 cr.

500. PEOPLES AND CULTURES OF NORTH AMERICA
Study of the economy, society, religion, art, and ideas of North American Indians from precolonial times to the present. 4 cr.

501. PEOPLES AND CULTURES OF THE MIDDLE EAST AND NORTH AFRICA
The role of ecological, social, cultural, and historical factors in shaping Middle Eastern and North African culture today. Special attention will be paid to family, values, and religion; to nomadic, village, and urban ways of life; and to issues of unity, diversity, colonialism, and culture change. 4 cr.

502. PEOPLES AND CULTURES OF AFRICA
Study of sub-Saharan economy, society, and culture from precolonial times to the present. 4 cr.

503. PEOPLES AND CULTURES OF OCEANIA
Study of the economy, society, religion, art, and ideology of Pacific Island cultures from precolonial times to the present. 4 cr.

504. PEOPLES AND CULTURES OF SOUTH ASIA
Emphasis on India, Sri Lanka, and Nepal. Traditional and changing South Asian cultures, including caste, family, economy, and religious traditions of Hinduism and Buddhism. 4 cr.

505. PEOPLES AND CULTURES OF SOUTHEAST ASIA
Geographical, historical, ethnic, and socio-cultural factors characteristic of the region. Impact of Indian, Chinese, Islamic, and European civilizations. Analysis of selected indigenous social, political, economic, and religious institutions. Prereq: Anth 411 or permission. 4 cr.

507. MESOAMERICAN PREHISTORY
Cultural development from earliest cultures through the Spanish conquest. Emphasis on origins of agriculture and rise of Olmec, Teotihuacan, Maya, Toltec, and Aztec civilization. Stress on factors critical to the development of complex societies. Prereq: Anth 412 or permission. 4 cr.

508. SOUTH AMERICAN PREHISTORY
Cultural development from earliest migrations through Inca Empire. Focus on major regions of South America. Consideration of Intermediate Area, Amazon Basin, and Central Andes as core regions for foundations of civilization. Prereq: Anth 412 or permission. 4 cr.

509. NORTH AMERICAN PREHISTORY
Archeology of the Indians north of Mexico from earliest evidence of settlement to European contact. Diversity of cultures from ecological and evolutionary perspectives. Emphasis on the Eastern Woodlands, the Plains, and the Southwest. Prereq: Anth 412 or permission. 4 cr.

510. NEAR EASTERN PREHISTORY
From earliest cultures to the development of agriculture and settled village life. Examines the processes that gave rise to the world's first civilizations. Prereq: Anth 412 or permission. 4 cr.

512. INTRODUCTION TO WORLD ETHNOGRAPHY
Primarily for majors and minors, but open to all students. Historical and geographic factors, types of social and economic organization, and problems involved in the comparative study of human societies and institutions. Analysis of selected peoples in the major ethnographic areas. Prereq: Anth 411 or equivalent; /or permission. 4 cr.

514. METHOD AND THEORY IN ARCHAEOLOGY
Basic method and theory; techniques in recovering and interpreting data; laboratory exercises in ceramic and lithic analysis. Critical evaluation of archaeological literature. Prereq: Anth 412 or permission. 4 cr.

515. ANTHROPOLOGY AND CONTEMPORARY ISSUES
Anthropological approaches to current world issues such as racism, poverty, religious movements, revolution, and environmental stress. Selected topics examined in the context of both western and nonwestern societies. 4 cr.

516. KINSHIP AND SOCIAL ORGANIZATION
The significance of kin and nonkin relations in human societies. Topics include the origins and evolution of human society, variations in the form and functions of marriage, family, and kin-based groups and selected nonkin relationships. Primary focus will be on nonindustrial societies. Prereq: Anth 411 or permission. 4 cr.

517. INTRODUCTION TO ANTHROPOLOGICAL ANALYSIS
Basic skills of reading, writing, and analysis essential to the study of anthropology. Focus on learning to recognize, compare, and critically evaluate the central arguments of several major books drawn from different subfields and orientations in anthropology. Small class size for extensive discussion and

feedback. Required for majors. Prereq: Anth 411 or 412; /or permission.

518. HISTORY OF ANTHROPOLOGICAL THEORY
Reading and discussion of the works of major theoreticians of American, British, and French schools. Selections from the works of Spencer, Morgan, Tylor, Boas, Kroeber, Lowie, Steward, White, Durkheim, Mauss, Lévi-Strauss, Malinowski, Radcliffe-Brown, Evans-Pritchard, and others are treated in terms of their contributions to the historical development of anthropology and their relevance to contemporary debates in anthropological theory. Prereq: Anth 411 or permission. 4 cr.

519. SOCIAL CHANGE AND DEVELOPMENT: AN ANTHROPOLOGICAL PERSPECTIVE
Extraordinary growth of European and American economic and political power since 1450. Major social, cultural, and economic changes resulting from this growth, described from the anthropological literature for the developing world. Existing theories reviewed in terms of their ability to explain these changes. 4 cr.

614. ECONOMIC ANTHROPOLOGY
Economics of nonindustrial societies; definition of economics; production, distribution, and consumption in selected societies; development. Prereq: Anth 411 or permission. 4 cr.

616. ANTHROPOLOGY OF RELIGION
Major anthropological theories of religion; analysis of religious beliefs as symbolic systems and their interrelations with ritual and other social institutions. Detailed study of specific religions. Prereq: Anth 411 or permission. 4 cr.

618. POLITICAL ANTHROPOLOGY
Political processes and structures in nonindustrial societies. Major topics: centralization of power and authority, legal systems, and warfare. Prereq: Anth 411 or permission. 4 cr.

625. FEMALE, MALE, AND SOCIETY
A critical, cross-cultural study of sex-related behavior in historical as well as contemporary perspective. Draws on anthropological, social-psychological, and sociological literature. Prereq: Anth 411 or Soc 400; /or permission. 4 cr.

630. ANTHROPOLOGICAL FIELD RESEARCH
Explores in theory and practice a range of approaches to doing field studies in anthropology. Techniques such as life histories, questionnaires, projective tests, participant observation, and field diaries will be explored in class and through active participation in a class research project. Prereq: Anth 411; one 500-level or higher anthropology course; /or permission. 4 cr.

697. SPECIAL TOPICS IN ANTHROPOLOGY
A) Social Organization; B) Economic Anthropology; C) Anthropology of Religion; D) Political Anthropology; E) Development; F) Cultural Ecology; G) Prehistoric Archaeology; H) Historic Archaeology; I) Cultural Resources Conservation; J) Lithic Analysis; K) Ceramic Analysis; L) Faunal Analysis; M) Human Evolution; N) Human Variation; O) Nomads; P) Marxist Anthropology; Q) Symbolic Anthropology; R) Women in Development; S) Other. New or specialized courses presenting material not normally covered in regular course offerings. May be repeated, but not in duplicate areas. Course descriptions on file in department office during registration. Prereq: Anth 411 or 412 (as appropriate); /or permission. 4 cr.

699. SENIOR THESIS
Independent work in the library or field; recommended for, but not confined to, majors intending to pursue graduate studies; required for honors candidates. Contact staff to obtain approval and arrange supervision. Should be taken next-to-last semester before graduation. 4 cr.

714. CASTE, CLASS, AND COLONIALISM
Peasants, urban communities, race and ethnicity, stratification, local-national integration, the effects of colonialism, modernization, and social change. Prereq: Anth 411 or permission.

731, 732. AREA STUDIES IN ARCHAEOLOGY
A) South America; B) Mesoamerica; C) North America; D) Other. Offered as staff is available and student needs dictate. Prereq: Anth 412; Anth 514; /or permission. 4 cr.

750. MIDDLE EAST: ISSUES OF ETHNICITY, WORK, AND IDENTITY
Community studies approach to such topics as: ethnicity and identity in the interrelationship of language, religion, and corporate membership in a community; ethnic division of labor; work, pluralism, and family networks; mobility and immobility; estates vs. classes. (Also offered as Soc 750.) 4 cr.

770. CULTURE, PERSONALITY, AND SOCIETY
A cross-cultural view of the development of personality as emergent from genetic, situational, and socio-cultural determinants; analysis of the dynamic interplay of socio-cultural and psychological behavior systems. Prereq: prior courses in sociology, anthropology, or psychology. (Also offered as Soc 770.) 4 cr.

795, 796. READING AND RESEARCH IN ANTHROPOLOGY
A) Cultural/Social Anthropology; B) Anthropological Linguistics; C) Archaeology; D) Physical Anthropology. Prereq: 12 credits of anthropology; permission. Variable (normally 2-8) cr.

797. ADVANCED TOPICS IN ANTHROPOLOGY
Advanced or specialized courses presenting material not normally covered in regular course offerings. May be repeated, but not in duplicate areas. Course descriptions on file in department office during registration. A) Social Organization; B) Economic Anthropology; C) Anthropology of Religion; D) Political Anthropology; E) Social Impact Analysis; F) Cultural Ecology; G) Prehistoric Archaeology; H) Historic Archaeology; I) Cultural Resources Conservation; J) Lithic Analysis; K) Ceramic Analysis; L) Faunal Analysis; M) Human Evolution; N) Human Variations; O) Anthropological Theory. Prereq: Anth 411 or 412 (as appropriate); /or permission. 4 cr.

Sociology (Soc)

(For program description, see page 34)

400. INTRODUCTORY SOCIOLOGY
Human social and cultural relationships as revealed in customs and institutions. Social theory, methods and techniques of research, and current research findings. Laboratory-problem method of instruction is offered occasionally; students interested should register for the section identified as "Laboratory" in the *Time and Room Schedule.* 4 cr.

500. INTRODUCTION TO SOCIAL PSYCHOLOGY
Social structure and culture, and human behavior. Sociological analysis of behavior in interpersonal relationships, small groups, formal organizations, and other social units. Social psychological issues within various institutions of society. 4 cr.

520. THE FAMILY
An anthropological and institutional approach comparing societal customs and organizations. Laboratory-problem method of instruction is offered occasionally; students interested should register for the section identified as "Laboratory" in the *Time and Room Schedule.* 4 cr.

530. RACE AND ETHNIC RELATIONS
Majority-minority group relations; special attention to nature and results of Black-White and ethnic group relations in the United States. 4 cr.

540. SOCIAL PROBLEMS
Relation of customs and institutions to crime, delinquency, alcoholism, physical and mental disease, sexual aberrations, poverty, old age, broken families, and racial and religious prejudices. Especially for nonmajors. 4 cr.

560. RURAL-URBAN SOCIOLOGY
Application of sociological and social psychological principles to the study of populations at various points on the rural-urban continuum. 4 cr.

599. CRITICAL ANALYSIS IN SOCIOLOGY
Basic skills essential to the study of sociology; development of critical reading of sociological literature through the practice of systematic evaluation of evidence and the process of theory construction; written and oral analysis of sociological classics; use of library resources. Required of sociology majors; open to other interested students. 4 cr.

600. SOCIAL INSTITUTIONS
Relationships among education, religion, economy, government, paedotrophic and inter-sex practices, art, and recreation. Cross-cultural approach. 4 cr.

601. METHODS OF SOCIAL RESEARCH
Cross-sectional and longitudinal survey design; direct and indirect measurement techniques; design of field and laboratory experiments; special topics. Prereq: major in sociology or social service; /or permission. 4 cr.

602. STATISTICS
Elementary applied statistical techniques; tables, graphs, cross-classifications; central tendency and dispersion; correlation and linear regression; confidence intervals and hypothesis testing. 4 cr.

611. HISTORY OF SOCIAL THEORY
Analysis of the writings of major contributors to the development of sociological theory from Plato to Max Weber. Special emphasis given to works of Marx, Weber, and Durkheim. 4 cr.

612. CONTEMPORARY SOCIOLOGICAL THEORY
Major schools, concepts, and issues in present-day sociological theory. Readings on functionalism, conflict theory, systems theory, critical theory, and hermeneutics. Prereq: Soc 611. 4 cr.

615. INTRODUCTORY CRIMINOLOGY
Scientific study of causes and control of crime. Indexes, rates, theories of crime and delinquency, police, courts, probation, prison, and parole. 4 cr.

620. STUDIES IN SOCIAL PSYCHOLOGY
Application of basic concepts of social psychology to a series of studies involving theoretical, methodological, and substantive issues. Prereq: Soc 500. 4 cr.

629. SMALL GROUPS
Interaction among individuals in small groups and between small groups; perception, attitude, and behavior. Analytical techniques are applied. A prior course in social psychology is recommended. 4 cr.

642. INTRODUCTION TO SOCIAL POLICY
Definition of social policy. Role of the social scientist in social policy research. Sociological research for policy decisions. Research examples in specific policy areas. Utilization of sociological research in policy decisions. 4 cr.

699. SENIOR THESIS
Independent work in the library or field; recommended for, but not confined to, majors intending to pursue graduate studies; required for honors candidates. Contact staff to obtain approval and arrange supervision. Should be taken next-to-last semester before graduation. 4 cr.

715. SOCIOLOGY OF CRIME AND JUSTICE
Seminar devoted to analyses of the relationships between violent, property, and "victimless" crime on the one hand and the police, judicial, and correctional components of criminal justice systems on the other. Prereq: Soc 615 or permission. 4 cr.

720. CURRENT DEVELOPMENT IN SOCIOLOGY OF THE FAMILY
A current topic will be selected each semester, such as stratification and the family, intrafamily communication, power structure of the family, kinship in modern societies. Critical review of the literature; class or individual research project usually will be carried out. Prereq: 8 credits of sociology; Soc 520 recommended. 4 cr.

721. FAMILY INTERACTION
Analysis of family interaction from a sociological perspective. Consideration of individual family members, relationships, and the family as a unit using a social systems approach. Prereq: Soc 400 or permission. 4 cr.

735. COMPLEX ORGANIZATIONS
Comparative study of the structure and dynamics of complex, formal organizations (business, military, political, and governmental, educational,

medical): power and social control; organizational processes, performances, and effectiveness; impact on persons and societies. Prereq: permission. 4 cr.

740. CULTURE CHANGE
Various types of society; development of theory. Descriptive studies of institutional as well as theoretical materials selected from the writings of Comte, Marx, Spencer, Durkheim, Spengler, Sorokin, Redfield, and others. 4 cr.

741. SOCIAL CHANGE AND SOCIETAL DEVELOPMENT
Comparative, interdisciplinary approach. Interrelationships among economic, political, and social factors in determining the structure, dynamics, character, and level of development of societies. Prereq: permission. Soc 740 recommended. 4 cr.

745. SOCIAL STRATIFICATION
Pattern of distribution of economic, honorific, and political variables within the populations of complex societies; allocation of personnel to the roles in question, notably through occupational mobility; and the impact of such processes upon behavior, both individual and social. Prereq: Soc 400 or 600. 4 cr.

750. MIDDLE EAST: ISSUES OF ETHNICITY, WORK, AND IDENTITY
Community studies approach to such topics as: ethnicity and identity in the interrelationship of language, religion, and corporate membership in a community; ethnic division of labor; work, pluralism, and family networks; mobility and immobility; estates vs. classes. (Also offered as Anth 750.) 4 cr.

757. SOCIAL INSTITUTIONS OF LATIN AMERICA AND THE CARIBBEAN
Selective analysis of distinctive institutions and social systems, with particular attention to social aspects of the process of modernization. Prereq: permission. 4 cr.

761. POPULATION DYNAMICS
Major population trends including changes in birth and death rates, population characteristics, mobility, migration, world population growth, population problems, and policies of countries at different stages of economic development. Interrelationship of population and society. 4 cr.

770. CULTURE, PERSONALITY, AND SOCIETY
A cross-cultural view of the development of personality as emergent from genetic, situational, and socio-cultural determinants; analysis of the dynamic interplay of socio-cultural and psychological behavior systems. Prereq: prior courses in sociology, anthropology, or psychology. (Also offered as Anth 770.) 4 cr.

780. SOCIAL CONFLICT
Nature, setting, and initiation of social conflict, its dynamics, and factors affecting its course and outcome. Prereq: permission. 4 cr.

785. THE STUDY OF WORK
Understanding society through the structure of work. Case studies, in an ethnographic manner, of high-status and low-status occupations to provide understanding of social processes and interrelationships in the social structure. 4 cr.

790. APPLIED SOCIOLOGY
1) Current level of use of sociological knowledge; 2) the advocate, consultant, and researcher roles in applied settings; 3) techniques of applied research; 4) implications of applied sociology, including ethical problems. Each student will focus on a social problem and write a paper covering the above issues. Applied projects where possible. Prereq: Soc 601. 4 cr.

795, 796. READING AND RESEARCH IN SOCIOLOGY
A) Communications; B) Criminology; C) Culture Change; D) Culture and Personality; E) Deviant Behavior; F) Family; G) Population; H) Rural-Urban; I) Social Control; J) Social Differentiation; K) Social Movements; L) Social Psychology; M) Social Research; N) Social Theory. Prereq: 12 credits of sociology or permission. 2-8 cr.

797. SPECIAL TOPICS IN SOCIOLOGY
A) Criminal Justice Field Work; B) Sociology of Crime and Justice; C) Sociology of Mental Health and Illness; D) Illness and Society; E) The Holocaust; F) Socio-Linguistics; G) Social Class and Family Patterns; H) Measurement in Sociology; I) Violence in the Family; J) Post-Industrial Society; K) Political Sociology; L) Bio-Sociology; M) Social Evolution; N) Social Differentiation; O) Modernization; P) Blacks in the Americas; Q) Religious Movements; R) American States and Regions. New or specialized courses presenting material not normally covered in regular course offerings. May be repeated, but not in duplicate areas. Course descriptions and prerequisites on file in department office during registration. 4 cr.

Soil Science

(See Institute of Natural and Environmental Resources)

Spanish

(See Ancient and Modern Languages and Literatures)

Technology (Tech)

Otis J. Sproul, Dean

The following courses are not necessarily offered every year.

405. INTRODUCTION TO COMPUTER TECHNOLOGY AND APPLICATIONS
Computer hard- and software; demonstrations, some "hands-on" experience with hardware, and some programming. Advantages and limitations of computers with respect to various applications (e.g., data processing, automation, education); impact on society (e.g., employment, privacy, war). No credit subsequent to C S 410, E E 712, 714. 4 cr.

610. INTRODUCTION TO OCEAN ENGINEERING
Seminar dealing with engineering problems in fields of current oceanographic interest. Marine biology, saturation diving systems, and physical oceanography. Engineering faculty and other experts in

ocean science and engineering. Prereq: permission. 4 cr.

650. COOPERATIVE WORK EXPERIENCE
Course required of all students participating in the College of Engineering and Physical Sciences Cooperative Program during employment semesters. Prereq: permission. 0 cr. Cr/F.

683. TECHNOLOGY: ITS ROLE AND FUNCTION IN SOCIETY
Impact of technology on social systems with current and historical examples. Interrelations between social customs, psychological responses, physical needs, and technological developments. Decision-making process in technological change; interrelationship between technology and public policy, Prereq: junior or senior standing; permission. 4 cr.

697. OCEAN PROJECTS
Students work as members of interdisciplinary project teams on contemporary ocean-related problems under the guidance of a faculty adviser. Student team defines problem, prepares a budget, conducts literature surveys, engages in dialogue with experts in the ocean community, deals with vendors, designs and builds a working engineering model, gathers and analyzes scientific data or conducts a comprehensive study, makes interim reports, and defends its results before a jury of experts. Prereq: normally senior standing and permission of the course director. A year-long course: 2 credits each semester, 4 credits total, and "IA" grade (continuous course) given at the end of the first semester. 4 cr.

Theater and Communication (ThCo)

(For program description, see page 27, 34)

CHAIRPERSON: Jean M. Brown
PROFESSORS: Joseph D. Batcheller, John C. Edwards
ASSOCIATE PROFESSORS: Jean M. Brown, Carol L. Burns, Gilbert B. Davenport, David J. Magidson, Joshua Meyrowitz, Wilburn L. Sims
ASSISTANT PROFESSORS: Raymond J. Bernier, Charles L. Robertson
FACULTY IN RESIDENCE: Judith B. Hartwell, Katherine Jacobs, John Lannamann, Richard Silvestro
INSTRUCTORS: Martin F. Allor, Paul Goodwin, Sheila McNamee

Communication

402. COMMUNICATION I
Introduction to human communication from a broad liberal arts perspective; issues include the impact of language and communication through the processes of intrapersonal, interpersonal, group, public, and mass communication. Freshman, sophomore priority. 4 cr.

403. PUBLIC SPEAKING
Sensitizes speakers and listeners; understanding and adapting to receivers, idea selection and development, message organization, and delivery. Nonverbal communication. 4 cr.

404. INTRODUCTION TO ARGUMENTATION
Principles of inquiry and advocacy. Philosophical and logical frameworks of argument; analysis, discovery, and testing of data; forms of argument; testing of arguments; patterns of proof. 4 cr.

405. ARGUMENTATION WORKSHOP
Basic principles of rational decision making through argumentation. Application in debate formats. May be repeated. Prereq: ThCo 404. 2 cr.

455. INTRODUCTION TO MASS COMMUNICATION
Nature, development, and effects of mass media. Overview of mass communication history and theory. 4 cr.

501. ARGUMENTATION II
Argument and advocacy as action on minds by means of discourse. Prereq: ThCo 404 or ThCo 405 or permission. 4 cr.

502. INTERPERSONAL LABORATORY
Integrates interpersonal theory and practice in a laboratory setting. Prereq: ThCo 402 and permission. 4 cr.

503. INTRODUCTION TO GROUP PROCESSES
Communication behavior in small groups. Problem-solving procedures, leadership, behavioral patterns, communication interaction patterns. Prereq: ThCo 402 or 403 or permission. 4 cr.

506. PERSUASION
Advanced course on problems of influencing human behavior. Practical applications. Prereq: ThCo 403 or permission. 4 cr.

533. INTRODUCTION TO FILM
Introduction to the art, history, technology, and theory of the narrative motion picture from the silent period to the present. Examination of films by such filmmakers as Griffith, Keaton, Eisenstein, Renoir, Welles, Hitchcock, Bergman, Kurosawa.. (Also offered as Engl 533; students majoring or minoring in communication or in theater must register for ThCo 533.) 4 cr.

556. INTRODUCTION TO TELEVISION PRODUCTION
Theory and actual studio experience, practice, and procedures. All aspects of television work and formats. Students operate every piece of studio equipment and write, produce, and direct several shows. Prereq: ThCo 455 or permission. 4 cr.

560. FILMMAKING
Theory of cinematic construction grounded in production work. Visualization, story-boarding, pictorial composition, creation of filmic reality, narrative devices, and editing. Students produce own short films. Lab fee. Prereq: permission. 4 cr.

567. IMAGES OF WOMEN IN THE MEDIA
Portrayal of women in a variety of media. Communication research methodologies employed to examine media attempts to persuade, reinforce, and manipulate attitudes. 4 cr.

572. LANGUAGE AND BEHAVIOR
Human symbol-using capacity and effects of language on behavior. Ways in which symbols help

create individual realities, reflect levels of personal judgment and adjustment, facilitate or hinder interpersonal communication. Application to verbal and nonverbal communication and contemporary and social issues. 4 cr.

580. BROADCAST NEWS PREPARATION/DELIVERY
Introduction to radio and television news writing, editing, and delivering. Emphasis on practical radio news writing experience. Prereq: permission. 4 cr.

595. SPECIAL TOPICS IN COMMUNICATION
Individual or group projects primarily in the communication option. By permission and arrangement with appropriate faculty. (May be repeated.) 2, 4, 6, or 8 cr.

602. THEORIES OF INTERPERSONAL COMMUNICATION
Contemporary perspectives on interpersonal communication; analytical emphasis on human communication behavior. Prereq: ThCo 402; at least one 500-level communication course. 4 cr.

603. THEORIES OF GROUP COMMUNICATION
Historical foundations and contemporary perspectives in group communication; analytical emphasis on human communication behavior. Prereq: ThCo 402; at least one 500-level communication course. 4 cr.

608. COMMUNICATION ANALOGS
Pragmatic analysis of communication problems. The level structure of human communication, system interaction and meta-communication, and paradoxes of communication behavior are examined through analogs and axioms of behavior as communication. Prereq: ThCo 402; at least one 500-level communication course. 4 cr.

616. STUDIES IN FILM
Advanced, focused study of the cinema. Topics vary from year to year and with instructor. The focus may range from general considerations of film theory, film criticism, and film history, to specific analyses of selected genres, directors, and periods. (Also offered as Engl 616; students majoring or minoring in communication or in theater must register for ThCo 616.) Prereq: Engl/ThCo 533 or instructor's permission. 4 cr.

630. PSYCHOLOGY OF COMMUNICATION
Concept-reference; vocal, visual, and verbal cues and attention. Prereq: ThCo 402; at least one 500-level communication course. 4 cr. (Not offered every year.)

632. COMMUNICATION THEORY
Terminology, concepts, theoretical models, functions, levels, modes and media, and role taking in human communication. Prereq: ThCo 402; any 500-level communication course; /or permission. 4 cr.

637. HISTORY AND LAW OF MASS COMMUNICATION
Media regulation discussed in historical/social contexts in which it took place. Begins with movable type and goes through present modes of regulation including executive, FCC, and the courts. Prereq: ThCo 455 and permission. 4 cr. (Offered every other year.)

656. PRINCIPLES OF RHETORICAL CRITICISM
Roles and methods of rhetorical critics. Historical background to rhetorical-critical structures and processes including neo-Aristotelian criticism and Burkeian criticism. Critical principles and practices. Seminar. Prereq: ThCo 403; or permission. 4 cr.

658. MEDIA ANALYSIS AND CRITICISM
Approaches and methodologies for media criticism. Analysis of sample studies. Students work on original media analysis projects. Prereq: ThCo 455; or permission. 4 cr.

673. RESEARCH METHODS IN COMMUNICATION
Prereq: permission. (May be repeated.) 4 cr.

683. GENDER AND EXPRESSION
The relationship between the social/cultural paradigm of gender and the existential paradigm of self. Analysis of the social construction of sexuality including language, patterns of dominance, social distribution of knowledge, media influence techniques, and the impact of feminism on these. Prereq: one communication course; one women's studies course; /or permission. 4 cr.

695. COMMUNICATION SEMINAR
An upper-level seminar; variable topics in communication research, theory, and practice. May be repeated for different topics. 4 cr.

747. INTERCULTURAL COMMUNICATION
A course which extends communication generalizations to intercultural problems. Relates concepts, approaches, and analyses of behavior to research and theory in international, cross-cultural, and comparative communication. Prereq: five communication courses, three of which must have been at the 500-600 level, or permission. 4 cr.

750. WRITING FOR PERFORMANCE
See theater offerings. 4 cr.

771. CRITICISM OF CONTEMPORARY RHETORIC
Applies rhetorical-critical systems and principles. Campaign rhetoric, agitative rhetoric, the rhetoric of religion, the rhetoric of militarism, the rhetoric of diplomacy, and the rhetoric of social movements. Course content variable. Prereq: ThCo 656 or permission. 4 cr.

772. MEDIA THEORY
Seminar. Focused analysis of specific theoretical principles of film, television, radio, and other media. Application to current examples in politics, advertising, and entertainment. Prereq: ThCo 455; ThCo 658; /or permission. 4 cr.

783. THEORIES OF LANGUAGE
Nature, uses, and roles of language. Representative theorists may include Carroll, Piaget, Sapir, Whorf, Vetter, Vygotsky, Weiner, Chomsky, Labov, Steward, Ogden and Richards, Ruesch, and Sullivan. Prereq: permission; or ThCo 572 and 673. 4 cr. (Not offered every year.)

Dance

461. MODERN DANCE I
An introductory course which includes techniques and improvisation as well as lectures in history and theory. 4 cr.

462. BALLET I
Introductory course; technique; historical development of ballet. 4 cr.

463. THEATER DANCE I
Introductory course; techniques; improvisation; lectures on jazz, ethnic, and other theatrical dance forms. 4 cr.

470. THEATER MOVEMENT
Stage movement for actors. Open to theater majors only. 2 cr.

561. MODERN DANCE II
Intermediate level course which includes techniques and improvisation. Prereq: ThCo 461 or permission. May be repeated for credit. 2 cr.

562. BALLET II
Extension of Ballet I syllabus; emphasis is on technique, with additional step vocabulary. Prereq: ThCo 462 or permission. May be repeated once for credit. 2 cr.

563. THEATER DANCE II
Technique; Afro-Cuban, modern, and East Indian dance; body movement through exercises and combinations involving stretch, strength, and flexibility. Prereq: ThCo 463 or permission. May be repeated once for credit. 2 cr.

633. DANCE COMPOSITION I
Practical, developmental approach to process of creating dances. Prereq: ThCo 561, 562, 563, or permission. 2 cr.

634. DANCE COMPOSITION II
Use of music; group choreography. Prereq: ThCo 633. 2 cr.

638. THE DANCE
Historical and philosophical consideration of dance trends. 4 cr.

640. LABANOTATION
Study and practice of recording human movement by the method of Labanotation. Prereq: permission. 2-4 cr.

661. MODERN DANCE III
Advanced-level course in technique and composition. Prereq: ThCo 561 or permission. May be repeated for credit. 2 cr.

662. BALLET III
Advanced level course in technique; pointe work included. Prereq: ThCo 562 or permission. May be repeated for credit. 2 cr.

663. THEATER DANCE III
Extension of Theater Dance I and II; brings students to a more advanced technical level. Prereq: Theater Dance I and II; or permission. May be repeated for credit. 2 cr.

684. SPECIAL TOPICS IN DANCE
Exploration of topics agreed upon by students and instructor. Topics vary. May be repeated. 2-4 cr.

732. CHOREOGRAPHY
Theoretical and practical consideration of the creative and aesthetic aspects of ballet, modern, and jazz dance. Prereq: ThCo 634 or permission. 4 cr.

Theater

435. INTRODUCTION TO THEATER (THEATER AND ITS DRAMA I)
Emphasis on modern theater forms; e.g., legitimate, musical, cinema, television. Survey of theater areas, personnel, and methods. Attendance at University Theater and Cultural Events productions. Minimal participation in laboratory and major productions. 4 cr.

436. HISTORY OF THEATER AND DRAMA (THEATER AND ITS DRAMA II)
History and theory in its social framework from the beginnings to 1800. 4 cr. (Not offered every year.)

438. HISTORY OF THEATER AND DRAMA (THEATER AND ITS DRAMA III)
1800 to present. 4 cr. (Not offered every year.)

457. ORAL INTERPRETATION
Analysis of literature for performance; demonstration and experimentation with performance methods; development of a critical standard for evaluation of performance and literature. 4 cr.

459. STAGECRAFT (SCENIC ARTS I)
Stage scenery construction and painting. Properties, sound, and backstage organization. Survey of costumes and lighting. Practical application in University Theater productions. 4 cr.

475. STAGE MAKEUP
Fundamentals of juvenile, old age, character, and special stage makeup techniques. Prereq: permission. Lab fee. 2 cr.

520. EDUCATION THROUGH DRAMATIZATION
Drama techniques applied to the classroom, including puppetry, storytelling, involvement theater. 4 cr.

541. ARTS ADMINISTRATION
Contemporary arts administration; theories and techniques of cultural resource development, organization, structure, labor relations, marketing, consumer behavior, public relations, fund raising, audience development, and long-range planning. 4 cr.

546. STAGE COSTUME DESIGN AND EXECUTION (SCENIC ARTS II)
Costume history, styles, design theory, patternmaking, and construction. Prereq: permission. 4 cr.

547. STAGE PROPERTIES
Research and manufacture of period and modern stage, trim, and hand properties. Prereq: ThCo 459. 4 cr.

548. STAGE LIGHTING DESIGN AND EXECUTION (SCENIC ARTS III)
Elementary electricity, design theory, instrumentation, control, and practice. 4 cr.

549. VOICE AND DICTION I
Based on individual needs; particular reference to theater, television, radio. Individual and group practice sessions. Coreq: ThCo 551. Prereq: permission. 2 cr.

550. VOICE AND DICTION II
Basic skills for oral interpretation, theater, etc., including analysis and development of dialects. Coreq: ThCo 552. Prereq: ThCo 549. 2 cr.

551. ACTING I
Development of fundamental vocal and physical stage techniques for actors and directors through exercises, improvisation, and theater games. Should be taken concurrently with ThCo 549. 2 cr.

552. ACTING II
Application of prior training in ThCo 551 (prerequisite) to building characterizations in scenes and short plays. Should be taken concurrently with ThCo 550. 2 cr.

583. PUPPETRY
Introduction to puppetry construction techniques and class production for education and recreation. Students provide own materials. 4 cr.

621. CREATIVE DRAMATICS
Exploration of drama techniques leading to design and execution of drama sessions with children in class. Prereq: permission. 4 cr.

622. THEATER FOR CHILDREN
The art of story theater production, storytelling, and involvement for both school and recreation programs. Students will observe and take part in the production of a play for children. 4 cr.

624. MUSICAL THEATER FOR CHILDREN
Musical production and writing techniques. Students take part in actual production. 4 cr.

627. METHODS OF EDUCATION THROUGH DRAMATIZATION
Materials and technique practicum for teaching material in ThCo 520. (Division of Continuing Education only.) Prereq: permission. 2-4 cr.

652. SCENE DESIGN (SCENIC ARTS IV)
Stage drafting, modules, materials, design theory, and styles. Individualized exercises, final project. Prereq: ThCo 459. 4 cr.

653. PERFORMANCE PROJECT
Application of acting and directing theory to assigned responsibilities in a University Theater production or to an individual performance project. Prereq: ThCo 551; 552; permission. To be taken in conjunction with ThCo 654, but not concurrently. May be repeated to 4 cr. 2 cr.

654. SCENIC ARTS PROJECT
Application of experience in design and technical aspects to assigned responsibilities in a University Theater production or to an individual project or presentation. Prereq: ThCo 459; 652; permission. To be taken in conjunction with ThCo 653, but not concurrently. May be repeated to 4 cr. 2 cr.

655. MUSICAL COMEDY WORKSHOP
Emphasis on developing audition, performance, and directing techniques, analysis. By audition only. 4 cr.

657. DIRECTING
Continuation of ThCo 552 (prerequisite). The director and performer develop interaction of the character. Ensemble playing. Full directing responsibility for a one-act play. 4 cr.

693. THEATER MANAGEMENT I
Theater organization, fund raising, public relations, audience development, business and box-office management. Special topics may be explored. Prereq: four courses in theater. 4 cr.

729. COMMUNITY-ORIENTED DRAMA PROGRAMS
Students develop programs and work in communities. 4 cr.

730. THEATER MANAGEMENT II
Theory and technique of theater management applied to a specific assignment; may involve internships with professional, community, or educational theaters. Prereq: ThCo 693. 4 cr.

741. PLAY ANALYSIS FOR PRODUCTION
Analysis and discussion to develop production concepts for actors, technicians, directors, designers, teachers. Prereq: ThCo 435, 436, or 438; either 459, or 551 and 552. 4 cr. (Not offered every year.)

750. WRITING FOR PERFORMANCE
Playwriting; radio, television, and film. Emphasis will vary. Focus on original work with possible performances in other classes. May be taken three times for credit. Prereq: permission. 4 cr.

755. MUSICAL THEATER STYLES
Representative scripts and scores depicting various American musical composer/lyricist styles. Prereq: ThCo 655. Lab. 4 cr.

758. ACTING III
Continuation of ThCo 657 and of the sequence begun in ThCo 551 and 552. Styles of drama for the actor and director. Greek, Shakespearean, 18th-century comedy, and 19th-century realism. Prereq: ThCo 551; ThCo 552; ThCo 657; /or equivalent. 4 cr.

768. GROUP INTERPRETATION
Choric speaking, reader's theater, chamber theater, and other forms of group interpretation in theory and practice. Prereq: ThCo 457. 4 cr.

781. THEATER WORKSHOP FOR TEACHERS
Intensive seminar-workshop. Rehearsal techniques, theater production, and stage direction; work in lab and in summer repertory theater production as applicable to secondary-school theater. Offered in the summer session. 4 cr.

782. THEATER WORKSHOP FOR TEACHERS
Continuation of ThCo 781 (not a prerequisite). Offered in the summer session. 4 cr.

General

691. LABORATORY OR FIELD EXPERIENCE
Taken in the senior year. 4 cr.

697. SENIOR SEMINAR
Meetings as preparation for senior project; overview of recent developments and trends in the oral communication arts and sciences. Prereq: senior standing. 2 cr.

698. SENIOR PROJECT
Further development and completion of senior project. Prereq: senior standing. 2 cr.

795, 796. INDEPENDENT STUDY
Advanced individual study in one of the three areas of the department. Could be combined with senior project (for majors) for a total of 12 credits in the same semester if the student wishes to study off campus. Project is to be developed with supervising instructor. May be repeated. 2, 4, 6, or 8 cr.

Women's Studies (W S)

(For program description, see page 24)

COORDINATOR: Cathryn Adamsky

401. INTRODUCTION TO WOMEN'S STUDIES
Interdisciplinary survey of the major areas of women's studies; women's history, cross-cultural perspectives, women in literature, psychology of women, etc. Basic principles and concepts fundamental to more advanced women's studies research. Topics vary. Required for minor. 4 cr.

595. SPECIAL TOPICS IN WOMEN'S STUDIES
In-depth study of topics not covered in regular course offerings. Prereq: permission. 4 cr.

795. INDEPENDENT STUDY
For advanced students who have the preparation to carry out an individual project of supervised research on a specific women's studies topic. Preparation should include W S 401 or equivalent, and/or other women's studies courses. Prereq: permission of instructor and women's studies coordinator. Barring duplication of topic, may be repeated for a maximum of 8 cr. 1-4 cr.

798. COLLOQUIUM IN WOMEN'S STUDIES
Intensive study of specialized topic for advanced students. Topics vary with instructor. Prereq: permission. Preference given to women's studies minors who have completed 12 W S credits. Required for W S minors. Barring duplication of topic, may be repeated for credit. 1-4 cr.

Wildlife Management

(See Institute of Natural and Environmental Resources)

Zoology (Zool)

(For program description, see page 35)

CHAIRPERSON: John E. Foret
PROFESSORS: Arthur C. Borror, Wilbur L. Bullock, Robert A. Croker, Evelyn E. Handler, Frank K. Hoornbeek, John J. Sasner, Jr.
ASSOCIATE PROFESSORS: John E. Foret, Edward N. Francq, James F. Haney, Larry G. Harris, Marcel E. Lavoie, Edward K. Tillinghast, Charles W. Walker
ASSISTANT PROFESSORS: W. Huntting Howell, Stacia A. Sower, James T. Taylor, Winsor H. Watson III
FACULTY IN RESIDENCE: David C. Ashley
LECTURER: Abigail R. Lumsden
ADJUNCT ASSISTANT PROFESSORS: John B. Heiser, Alan W. Hulbert

412. PRINCIPLES OF ZOOLOGY
Concepts of animal biology, introduction to ecological relationships, anatomy, physiology, embryology, taxonomy, and evolution. Intended principally for majors in the biological sciences. Lab. 4 cr.

504. HEREDITY AND EVOLUTION
Gene and chromosomal basis of variation and evolution: chemical, physical, and statistical concepts. No credit toward zool major. Students may not receive credit for both Zool 504 and 604. 4 cr.

507-508. HUMAN ANATOMY AND PHYSIOLOGY
All systems in human body. Laboratories: a dissection of preserved cats and experiments with living tissues. Lab fee $5 per semester. (Students may not receive credit for both Zool 507-508 and Zool 519.) 4 cr.

518. VERTEBRATE MORPHOLOGY
Basic morphological features of vertebrates. Structure of the major systems at macroscopic and microscopic levels. Prereq: Zool 412. Lab. 5 cr.

519. COMPARATIVE ANIMAL PHYSIOLOGY
Principles and comparative function of cell, organ, and system levels of animal respiration, circulation, fluid regulation, energetics, coordination, and neuroendocrine mechanisms. Prereq: Zool 518 or 528; or equivalent. Chem 403-404. Lab. 4 cr.

528. INTRODUCTORY INVERTEBRATE ZOOLOGY
Lecture and laboratory survey of invertebrate phyla; systematic morphology, phylogeny, and natural history. Prereq: Zool 412. Lab. 4 cr.

542. ORNITHOLOGY
Identification and biology of birds, especially those of northeastern United States. Field trips, laboratory, and lectures. Prereq: one semester of biology. 4 cr.

560. ANATOMY AND BEHAVIOR OF THE GULL
Daily lectures; lecture demonstrations, laboratories, and field work. Functional anatomy of all organ systems, with emphasis on sensory, nervous, digestive, and respiratory systems. The large nesting colonies of two species of gulls on Appledore Island will be used to demonstrate territoriality, aggression, mating, and other basic patterns of gull behavior. Prereq: one course in college level biology. Staff. 1 cr. Cr/F. (Summer only.)

596. INTRODUCTION TO DESERT MOUNTAIN ECOLOGY
Field comparisons of plant and animal communities in habitats ranging from Chihuahuan desert

through spruce/fir forests. Offered in the Chiricahua Mountains of southeast Arizona. Travel and living expense. Interested students should contact instructor in September. Prereq: permission. 2 cr. (Winters only, alternate years.)

603. OCEAN BIOLOGY
Emphasis on organization of marine biological communities using rocky intertidal systems as an example. Various marine environments—pelagic, benthic, temperate, tropical—and their characteristic communities; survey of approaches: trophic structure, predator-prey, sampling techniques. Two lectures, two labs/week. Prereq: junior status; major in a science; permission. 4 cr.

604. PRINCIPLES OF GENETICS
Chemical and physical basis of inheritance; genes and chromosomes as units of mutation; genes in populations. Prereq: basic laboratory course in biological sciences. Organic chemistry and college math or statistics suggested. (Offered as PlSc 604 alternate semester.) Students may not receive credit for both Zool 504 and 604. 4 cr.

629. DEVELOPMENTAL BIOLOGY OF THE VERTEBRATES
Principles of animal development including metamorphosis, regeneration, and aging in selected vertebrates. Prereq: Zool 518, 519, and 604. Lab. 4 cr.

674. FIELD MARINE SCIENCE
Daily lectures; laboratory and field work. Offered at the Isles of Shoals in cooperation with Cornell University. An initial overview of the marine sciences, emphasizing living material in natural habitats; biology of intertidal plants and animals; biological oceanography; ichthyology; and fisheries. Also introductory physical and chemical oceanography, marine geology, marine ecology, and the effects of human activity on the marine environment. Prereq: at least a full year of college biology. 6 cr. (Summer only.)

704. COMPARATIVE ENDOCRINOLOGY
Endocrine organs; relationship to control of the internal environment, growth, development, and adaptation to external environment. Prereq: Zool 518; Zool 519; organic chemistry. 4 cr.

707. HUMAN GENETICS
Inheritance patterns; gene and chromosome mutation rates and effects; linkage and gene frequency. Prereq: Zool 604 or equivalent; /or permission. 4 cr. (Not offered every year.)

711. NATURAL HISTORY OF COLD-BLOODED VERTEBRATES
Classes of poikilothermic vertebrates; their habitats, and life histories in eastern North America. Prereq: general zoology; Zool 518. Lab. 4 cr.

712. MAMMALOGY
Origins, diversification, reproduction, ecology, behavior of mammals. Identification of local forms. Prereq: Zool 518. Lab. 4 cr.

713. ANIMAL BEHAVIOR
Individual and social behavior. The role of anatomy, physiology, ecology, and prior experience. Techniques and practical application. Prereq: one year of zoology. Lab. 4 cr.

715. NATURAL HISTORY OF MARINE INVERTEBRATES
Field and laboratory course; inshore marine invertebrate metazoan animals of northern New England. Identification, classification, habitat preferences, and behavior. Work (collection and observation) constitutes a major part of the course. Some travel expense. Prereq: general zoology. 6 cr. (Summer only, not offered every year.)

717. GENERAL LIMNOLOGY
Special relationships of freshwater organisms to the chemical, physical, and biological aspects of the aquatic environment. Factors regulating the distribution of organisms and primary and secondary productivity of lake habitats. Prereq: Biol 541 or equivalent. 4 cr.

719. FIELD LIMNOLOGY
Freshwater ecology examined through laboratory exercises with freshwater habitats. Methods to study freshwater lakes; interpretation of data. Seminars and occasional Saturday field trips. Prereq: present or prior enrollment in Bot 717, Zool 717, or equivalent; permission. 4 cr.

720. FIELD MARINE SCIENCE FOR TEACHERS
Primarily for teachers grades 6 through 12, but open to others. Overview of living marine organisms (algae, invertebrates, fishes, marine mammals, and shore birds) in their natural environments. Also such topics as coastal zone problems, marine fisheries, economics of marine organisms, and the educational resources of the marine environment. Field work. Offered at the Isles of Shoals (Shoals Marine Laboratory) in cooperation with Cornell University. Three lectures and two labs or field trips per day. Prereq: college-level introductory biology. 1 cr. (Summer only.)

721. PARASITOLOGY
Introduction to the more important parasites causing disease in humans and animals. Living materials will be used as much as possible. Prereq: one year of zoology. Lab. 4 cr. (Not offered every year.)

723. CELL PHYSIOLOGY
Principles of chemistry and physics applied to understanding cell structure and function. Metabolic reactions and their control in relation to cell organization; genesis and function of specialized cells. Prereq: organic chemistry. Lab. 4 cr.

728. DEVELOPMENTAL BIOLOGY OF THE INVERTEBRATES
Principles of animal development. Cellular processing of developmental information. Reproduction and development in the invertebrates. Prereq: Zool 412 or 528. Lab. 4 cr.

730. VERTEBRATE HISTOLOGY
Microscopic anatomy of vertebrate tissues and organs at the light microscope level; emphasis—mammalian histology; some comparative study of lower vertebrates. Prereq: Zool 508 or 518, or equivalent. Lab. 4 cr.

732. SOIL ZOOLOGY
Faunal communities of terrestrial soils, their ecology and natural history. Effects of animal activities on soil processes and composition. Collection, extraction, and study methods. Independent projects.

Prereq: Biol 541 or equivalent; permission. 4 cr. (Not offered every year.)

751. ADAPTATIONS OF MARINE ORGANISMS
Ecological physiology of selected algae and invertebrates from the Gulf of Maine. Offered at the Shoals Marine Lab (Isles of Shoals) in cooperation with Cornell University. Prereq: field marine science, plant or animal physiology, physiological ecology; understanding of chemical quantitative methods and analysis. 4 cr. (Summer only.)

753. MARINE VERTEBRATES
Lectures, laboratories, and field work on the systematics, ecology, and physiology of fishes, marine reptiles, marine birds, and marine mammals of the Gulf of Maine. Offered at the Shoals Marine Lab (Isles of Shoals) in cooperation with Cornell University. Prereq: field marine science or vertebrate biology. 4 cr. (Summer only.)

772. FISHERIES BIOLOGY
Information and techniques used by fisheries biologists. Emphasis on fish life history, ecology, and economics as related to management techniques. Prereq: Zool 711 or equivalent; permission. Lab. 4 cr.

775. INVERTEBRATE EMBRYOLOGY
Comparative study of reproduction and early development in selected invertebrates, providing a classical approach to morphology of gonads, fertilization, cleavage, gastrulation, and formation of larvae. Prereq: field marine sci (UNH), Biol Sci. 364 (Cornell), or invertebrate zoology. Offered at the Shoals Marine Lab (Isles of Shoals) in cooperation with Cornell University. 4 cr. (Summer only; not offered every year.)

777. INTRODUCTION TO NEUROBIOLOGY
The nervous system, with emphasis on vertebrate and invertebrate preparations which most clearly demonstrate the basic concepts of neurobiology. Topics include: structure and function of neurons, development, cellular basis of behavior (sensory and motor systems), neuropharmacology, and neural plasticity (learning). Prereq: Zool 412 or permission. 4 cr.

778. COMPARATIVE NEUROPHYSIOLOGY
Designed for students of the behavioral and physiological sciences who wish to understand the basic electrophysiological properties of neurons and how they interact. Both invertebrate and vertebrate systems will be used to illustrate principles of synaptic transmission, integration, sensory information processing, and the control of movement. Prereq: Zool 777 or permission. Lab. 4 cr.

791, 792. ADVANCED STUDIES IN ZOOLOGY
A) Marine Ecology; B) Stream Ecology; C) Freshwater Zooplankton Ecology; D) Population Ecology; E) Advanced Invertebrate Zoology; F) Protozoology; G) Comparative Physiology; H) Concepts and Techniques in Reproductive Biology. Graduate level courses open to advanced undergraduates wishing a more detailed treatment of a field. Limited enrollment. Research-oriented with outside readings primarily from the original scientific literature. Enrollment by permission of instructor only; priority given to graduate students. 4 cr.

795, 796. SPECIAL PROBLEMS IN ZOOLOGY
B) Ecology; C) Endocrinology; D) Evolution; E) Developmental Biology; F) Genetics; G) Histology; H) History of Zoology; I) Invertebrate Zoology; J) Physiology; K) Vertebrate Zoology; L) Zoogeography; M) Zoological Techniques; N) Parasitology; O) Histochemistry; P) Protozoology; Q) Systematics; R) Animal Behavior; S) Teaching Practices; T) Underwater Research. Students may elect one or more sections for advanced study. Reading, laboratory work, organized seminars, conferences. Prereq: permission. (Limit of 12 credits from the sections of this course.) 1-4 cr.

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Registrar

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Faculty Emeriti

(with length of service)

Abbott, Helen D.
Associate Professor Emerita, Library; A.B., Wheaton College, 1929; S.B. in L.S., Simmons College, 1930; A.M., Middlebury College, 1939; (1943 to 1972).

Allen, Fred E.
Professor Emeritus of Animal Sciences; B.S., University of New Hampshire, 1932; D.V.M., Ohio State University, 1936; (1940 to 1976).

Anderson, Charlotte K.
Professor Emerita, Library; B.A., University of Michigan, 1935; A.B.L.S., ibid., 1936; A.M.L.S., ibid., 1951; (1943 to 1980).

Babcock, Donald C.
Professor Emeritus of Philosophy; B.A., University of Minnesota, 1907; M.A., ibid., 1908; S.T.B., Boston University, 1912; D.H.L. (Hon.), University of New Hampshire, 1960; (1918 to 1956).

Barraclough, Kenneth E.
Professor Emeritus of Forestry, Extension Forester Emeritus; B.A., New York State College of Forestry, Syracuse University, 1921; M.F., Harvard University, 1940; (1926 to 1963).

Barton, Philip S.
Director Emeritus, Thompson School of Applied Science and Thompson School Professor Emeritus of Applied Animal Science; B.S., University of New Hampshire, 1928; M.Ed., ibid., 1938; (1939 to 1969).

Beckett, John A.
Forbes Professor Emeritus of Management; B.S., University of Oregon, 1939; M.B.A., Harvard University, 1946; C.P.A.; (1962 to 1981).

Beckwith, Marion C.
Professor Emeritus of Physical Education; A.B., Oberlin College, 1935; M.Ed., University of New Hampshire, 1937; (1935 to 1979).

Blickle, Robert
Professor Emeritus of Entomology; B.S., Ohio State University, 1937; M.S., University of New Hampshire, 1939; Ph.D., Ohio State University, 1942; (1939 to 1941, 1946 to 1979).

Blood, Edward
Assistant Professor Emeritus of Physical Education and Supervisor of Athletic Facilities Emeritus; B.S., University of New Hampshire, 1935; (1936 to 1971).

Boynton, C. Hilton
Professor Emeritus of Dairy Science and Extension Dairyman Emeritus; B.S., Iowa State College, 1934; M.S., ibid., 1940; Ph.D., Rutgers University, 1962; (1945 to 1972).

Brackett, Thelma
University Librarian Emerita; A.B., University of California, 1919; Certificate, California State Library School, 1920; D.H.L. (Hon.), University of New Hampshire, 1962; (1942 to 1961).

Bratton, Karl H.
Professor Emeritus of Music; B.M., University of Kansas, 1931; M.A., Teachers College, Columbia University, 1945; (1945 to 1971).

Breeding, Charles H. J.
Thompson School Professor Emeritus of Applied Soil Science; B.S., University of New Hampshire, 1949; M.S., ibid., 1966; (1963 to 1980).

Browne, Evelyn
Professor Emerita of Physical Education; A.B., University of California at Berkeley, 1942; M.A., Teachers College, Columbia University, 1943; M.A., University of New Hampshire, 1960; (1942 to 1981).

Bruns, Paul E.
Professor Emeritus of Forest Resources; A.B., New York University, 1937; M.F., Yale University, 1940; Ph.D., University of Washington, 1956; (1958 to 1980).

Carroll, Herbert A.
Professor Emeritus of Psychology; A.B., Bates College, 1923; A.M., Brown University, 1928; Ph.D., Columbia University, 1930; (1941 to 1962).

Chapman, Donald H.
Professor Emeritus of Geology; B.A., University of Michigan, 1927; M.A., ibid., 1928; Ph.D., ibid., 1931; (1931 to 1974).

Conklin, James G.
Professor Emeritus of Entomology; B.S., Connecticut Agricultural College, 1926; M.S., University of New Hampshire, 1929; Ph.D., Ohio State University, 1941; (1931 to 1971).

Corbett, Alan C.
Associate Professor Emeritus of Animal Science and Veterinarian; B.S., University of Maine, 1936; M.S., ibid., 1937; D.V.M., Michigan State College, 1940; (1940 to 1978).

Daggett, Albert F.
Professor Emeritus of Chemistry; B.S., University of New Hampshire, 1928; M.S., ibid., 1930; Ph.D., Columbia University, 1934; (1928 to 1931, 1935 to 1976).

Dawson, Charles O.
Professor Emeritus of Civil Engineering; B.C.E., Ohio State University, 1930; M.S.C.E., ibid., 1940; (1930 to 1976).

DeQuoy, Ruth W.
Associate State 4-H Leader Emerita; B.A., New Hampshire College, 1921; M.Ed., University of Maryland, 1953; (1929 to 1965).

Deichert, Lillian C.
Associate Professor Emerita, Loan Librarian; A.B., Hunter College, 1933; M.L.S., Pratt Institute, 1960; (1964 to 1975).

Dodds, John A.
Thompson School Associate Professor Emeritus of Applied Animal Science; B.S., University of Vermont, 1936; M.Agr.Ed., University of New Hampshire, 1960; (1953 to 1979).

Dunlop, William R.
Professor Emeritus of Animal Science; D.V.M., V.S., Ontario Veterinary College, 1938; (1950 to 1981).

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* Indicates time devoted to Cooperative Extension Service
† Indicates time devoted to Agricultural Experiment Station

Dunn, Gerald M.
Professor Emeritus of Plant Science; B.S., West Virginia University, 1948; M.S., Purdue University, 1950; Ph.D., ibid., 1951; (1951 to 1982).

Eggert, Russell
Professor Emeritus of Horticulture; B.S., Michigan State College, 1929; M.S., ibid., 1939; (1942 to 1946, 1948 to 1970).

Ellis, Elizabeth E.
Extension Associate Professor Emerita of Home Economics; B.S., Teachers College, Columbia University, 1927; M.A., ibid., 1929; (1929 to 1960).

Fernald, Mary L.
Associate Professor Emerita of Nursing; B.S., University of New Hampshire, 1931; Dipl., Children's Hospital School of Nursing, 1935; M.A., Teachers College, Columbia University, 1947; (1964 to 1974).

Granger, Ralph H.
Assistant Director Emeritus, Thompson School of Applied Science, and Thompson School Associate Professor Emeritus of Applied Business Management; B.S., University of Massachusetts, 1935; M.S., ibid., 1939; (1946 to 1976).

Haendler, Helmut M.
Professor Emeritus of Chemistry; B.S.Ch.E., Northeastern University, 1935; Ph.D., University of Washington, 1940; (1945 to 1978).

Hall, Harry H.
Professor Emeritus of Physics; B.S., Union College, 1926; Ph.D., Harvard University, 1934; (1940 to 1969).

Haslerud, George M.
Professor Emeritus of Psychology; B.A., University of Minnesota, 1930; Ph.D., ibid., 1934; (1945 to 1972).

Hitchcock, Leon W.
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Hoitt, Samuel W.
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Holden, John T.
Professor Emeritus of Political Science; A.B., Wesleyan University, 1936; M.P.A., Harvard University, 1941; M.A., ibid. 1942; Ph.D., ibid., 1943; LL.D. (Hon.), Nasson College, 1958; (1947 to 1972).

Holder, Mary
Associate Professor Emeritus of Home Economics; B.S., Mount Allison University, 1940; M.S., Michigan State University, 1949.

Hraba, John B.
Director Emeritus of System Planning and Professor Emeritus of Electrical Engineering; B.S., University of New Hampshire, 1948; M.Eng., Yale University, 1949; Ph.D., University of Illinois, 1955; (1949 to 1981).

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Professor Emeritus of Mathematics; B.A., Intermountain Union College, 1934; M.A., University of Washington, 1938; Ph.D., University of Wisconsin, 1941; (1966 to 1978).

Keener, Harry A.
Dean Emeritus of the College of Life Sciences and Agriculture, Director Emeritus of the Agricultural Experiment Station and Professor Emeritus of Animal Science; B.S., Pennsylvania State University, 1936; M.S., West Virginia University, 1938; Ph.D., Pennsylvania State University, 1941; (1941 to 1978).

Kennedy, Robert G.
Thompson School Professor Emeritus of Applied Plant Science; B.V.A., University of Massachusetts, 1940; M.S., University of New Hampshire, 1961; (1941 to 1980).

Langer, Clarence A.
Professor Emeritus of Plant Science and Extension Horticulturist Emeritus, Fruits; B.S., Michigan State University, 1933; M.S., ibid., 1948; Ph.D., ibid., 1952; (1962 to 1974).

Leighton, Roger
Associate Extension Educator Emeritus, Program Leader Forestry Emeritus and CFM Supervisor Emeritus; (1952 to 1979).

Marschner, Donald C.
Professor Emeritus of Business Administration; B.A., Brown University, 1929; Ph.D., Columbia University, 1964; (1964 to 1975).

Metcalf, Theodore G.
Professor Emeritus of Microbiology; B.S., Massachusetts College of Pharmacy, 1940; Ph.D., University of Kansas, 1950; (1956 to 1981).

Meyers, T. Ralph
Professor Emeritus of Geology; B.A., Ohio State University, 1926; M.A., ibid., 1929; (1927 to 1972).

Milne, Lorus J.
Professor Emeritus of Zoology; B.A., University of Toronto, 1933; M.A., Harvard University, 1934; Ph.D., ibid., 1936; (1948 to 1976).

Morrow, Kenneth S.
Professor Emeritus of Dairy Science; B.S., University of Minnesota, 1918; M.S., ibid., 1925; (1934 to 1966).

Nast, Charlotte G.
Professor Emerita of Botany; B.A., University of Wisconsin, 1927; M.A., ibid., 1929; Ph.D., University of California, 1938; (1948 to 1970).

O'Donnell, Dorothy C.
Associate Professor Emerita of Home Economics and Extension Specialist Emerita, Interior Design; B.S., Cornell University, 1946; M.S., University of Wisconsin, 1952; M.S., ibid., 1955; (1961 to 1980).

Owen, Margaret
Assistant Professor Emerita, Order Librarian; A.B., Mount Holyoke College, 1919; (1943 to 1961).

Partridge, Allan B.
Associate Professor Emeritus of History; A.B., Clark University, 1922; A.M., ibid., 1923; (1925 to 1971).

Petroski, Joseph J.
Associate Professor Emeritus of Education; B.S., University of New Hampshire, 1947; M.Ed., ibid., 1952; Ed.D., Harvard University, 1960; (1966 to 1978).

Pew, Richard
Associate Professor Emeritus of Hotel Administration; B.S., Cornell University, 1933; (1963 to 1974).

Rand, M. Elizabeth
Associate Professor Emerita of Home Economics; A.B., Wheaton College, 1930; M.Ed., Boston University, 1946; (1948 to 1973).

Rich, Avery E.
Associate Dean Emeritus of the College of Life Sciences and Agriculture and Professor Emeritus of Plant Pathology; B.S., University of Maine, 1937; M.S., ibid., 1939; Ph.D., State University of Washington, 1950; (1941 to 1943, 1950 to 1982).

Richardson, Edythe T.
Professor Emerita of Zoology; B.S., New Hampshire College, 1922; M.S., University of New Hampshire, 1924; (1922 to 1966).

Ringrose, Richard C.
Professor Emeritus of Animal Science; B.S., Cornell University, 1932; Ph.D., ibid., 1936; (1942 to 1975).

Sackett, Everett B.
Dean Emeritus of the College of Liberal Arts and Professor Emeritus of Education; B.A., Hamline University, 1926; M.A., University of Minnesota, 1926; Ph.D., Columbia University, 1931; (1938 to 1967).

Shimer, Stanley R.
Professor Emeritus of Biochemistry; B.S., Muhlenberg College, 1918; M.S., Pennsylvania State College, 1923; (1924 to 1966).

Skelton, Russell R.
Professor Emeritus of Civil Engineering; B.S., Purdue University, 1924; C.E., ibid., 1934; S.M., Harvard University, 1939; (1928 to 1966).

Skoglund, Winthrop C.
Professor Emeritus of Animal Science; B.S., University of New Hampshire, 1938; M.S., Pennsylvania State College, 1940; Ph.D., Pennsylvania State University, 1958; (1950 to 1981).

Slanetz, Lawrence W.
Professor Emeritus of Microbiology; B.S., Connecticut State College, 1929; Ph.D., Yale University, 1932; (1932 to 1977).

Smith, Gerald L.
Associate Professor Emeritus of Animal Science and Extension Animal Scientist; B.S., University of New Hampshire, 1948; M.S., Pennsylvania State College, 1951; (1948 to 1980).

Stewart, Glenn W.
Associate Professor Emeritus of Geology and State Geologist; B.S., University of New Hampshire, 1935; M.S., Syracuse University, 1937; M.A., Harvard University, 1950; (1938 to 1939, 1941 to 1979).

Stolworthy, Edward H.
Professor Emeritus of Mechanical Engineering; B.S., Tufts College, 1922; D.Eng. (Hon.), University of New Hampshire, 1974; (1922 to 1968).

Swan, Emery F.
Professor Emeritus of Zoology; S.B., Bates College, 1938; Ph.D., University of California, 1942; (1952 to 1978).

Swasey, Henry C.
Associate Professor Emeritus of Physical Education and Athletics for Men; B.S., Amherst College, 1915; M.S., Indiana University, 1941; (1921 to 1963).

Sweet, Paul C.
Coach of Track and Cross Country and Professor Emeritus of Physical Education; B.S., University of Illinois, 1923; M.S., University of Southern California, 1941; (1924 to 1970).

Teeri, Arthur E.
Professor Emeritus of Biochemistry; B.S., University of New Hampshire, 1937; M.S., ibid., 1940; Ph.D., Rutgers University, 1943; (1938 to 1940, 1943 to 1982).

Thomas, George R.
Professor Emeritus of the Arts; B. Arch., Carnegie Institute of Technology, 1930; (1930 to 1976).

Tyrrell, Doris E.
Associate Professor Emerita of Secretarial Studies; B.S., University of Minnesota, 1926; M.A., ibid., 1932; (1938 to 1966).

Vreeland, Robert P.
Associate Professor Emeritus of Civil Engineering; B.S., Yale University, 1932; M.S., Columbia University, 1933; M.E., Yale University, 1941; (1966 to 1977).

Wallace, Oliver P., Sr.
Associate Professor Emeritus of Forest Resources; B.S., University of New Hampshire, 1937; B.S.F., University of Michigan, 1938; M.F., ibid., 1947; Ph.D., ibid., 1954; (1958 to 1982).

Walsh, John S.
Professor Emeritus of Languages; A.B., Harvard University, 1915; A.M., Boston University, 1928; D.H.L. (Hon.), University of New Hampshire, 1965; (1922 to 1962).

Warren, Richard G.
Professor Emeritus of Poultry Science and Extension Poultryman Emeritus; B.S., Cornell University, 1934; M.S., ibid., 1935; (1937 to 1970).

Webster, Robert G.
Professor Emeritus of English; B.A., University of New Hampshire, 1926; M.A., ibid., 1930; (1927 to 1970).

Weeks, Silas B.
Associate Professor Emeritus of Resource Economics and Extension Community Resource Development Specialist Emeritus; B.S., Cornell University, 1937; (1955 to 1981).

Whitlock, John B.
Associate Professor Emeritus of Music; B.Ed., Southern Illinois Normal University, 1937; M.A., State University of Iowa, 1941; Ph.D., ibid., 1958; (1958 to 1981).

Woodruff, Ruth J.
Professor Emerita of Economics; B.A., Bryn Mawr College, 1919; A.M., ibid., 1920; Ph.D., Radcliffe College, 1931; (1931 to 1967).

Wooster, Caroline S.
Associate Professor Emerita of Physical Education; Cert., Sargent School for Physical Education, 1926; B.S., University of New Hampshire, 1934; (1944 to 1970).

Wurzburg, Frederic W.
Associate Professor Emeritus of Political Science; B.S., Columbia University, 1956; Ph.D., ibid., 1961.

Zimmerman, Oswald T.
Professor Emeritus of Chemical Engineering; B.S.E., University of Michigan, 1929; M.S.E., ibid., 1931; Ph.D., ibid., 1934; (1938 to 1970).

Faculty

(with date of appointment)

Abeles, Sigmund M. (1970)
Professor of the Arts; A.B., University of South Carolina, 1955; M.F.A., Columbia University, 1957.

Adamovich, Frank W. (1968)
Assistant Professor and Documents Librarian; B.S., Fitchburg State Teachers College, 1960; M.S., Simmons College, 1968.

Adams, Robert L. A. (1967)
Assistant Professor of Geography; B.A., Williams College, 1961; M.A., Clark University, 1966; Ph.D., ibid., 1971.

Adamsky, Cathryn (1981)
Associate Professor of Women's Studies; B.A., Clark University, 1955; Ph.D., University of Rochester, 1959.

Aikins, Janet (1979)
Assistant Professor of English; B.A., Grinnell College, 1972; M.S., University of Chicago, 1973; Ph.D., ibid., 1980.

Alexander, Lori A. (1981)
Assistant Professor of Physical Education; B.S., Brooklyn College, 1976; M.S., University of Massachusetts, 1977; Ph.D., Ohio State University, 1980.

Allar, Gregory W. (1982)
Faculty in Residence in Spanish; B.A., Oakland University, 1971; M.A., University of Michigan, 1973; M.A., ibid., 1976; Ph.D., ibid., 1977.

Allmendinger, E. Eugene (1958)
Director of Marine Operations and Associate Professor of Naval Architecture; B.S., University of Michigan, 1941; M.S., University of New Hampshire, 1950.

Allor, Martin F. (1982)
Instructor in Theater and Communication; B.A., Oakland University, 1977.

Alonzo, Roy S. (1969)
Thompson School Associate Professor of Food Services Management; B.S., Boston University, 1953; M.B.A., Western New England College, 1961; Ed.D., Nova University, 1978.

Amell, Alexander R. (1955)
Professor of Chemistry; B.S., University of Massachusetts, 1947; Ph.D., University of Wisconsin, 1950.

Amsden, Katherine (1967)
Associate Professor of Physical Education; A.B., Sweet Briar College, 1953; M.S., Smith College, 1956; Ph.D., University of Southern California, 1967.

Andersen, Kenneth K. (1960)
Professor of Chemistry; B.S., Rutgers University, 1955; Ph.D., University of Minnesota, 1959.

Anderson, Franz E. (1967)
Professor of Geology; B.A., Ohio Wesleyan University, 1960; M.A., Northwestern University, 1962; Ph.D., University of Washington, 1967.

Andrew, David S. (1976)
Associate Professor of the Arts; B.A., University of Michigan, 1965; M.A., ibid., 1968; Ph.D., Washington University, 1977.

Andrew, Michael D. (1966)
Associate Professor of Education; B.S., Cornell University, 1960; A.M.T., Harvard University, 1961; Ed.D., ibid., 1969.

†Andrews, Richard A. (1959)
Professor of Resource Economics; B.S., University of Maine, 1949; M.S., Pennsylvania State University, 1951; Ph.D., University of Minnesota, 1959.

Annis, William H. (1962)
Professor of Occupational Education; B.S., University of Maine, 1951; M.Agri.Ed., University of New Hampshire, 1959; Ed.D., Cornell University, 1961.

Antonak, Richard F. (1975)
Associate Professor of Education; B.A., Rutgers University, 1969; M.Ed., Temple University, 1970; Ed.D., ibid., 1975.

Antosiewicz, Rose T. (1970)
Associate Professor of Italian; A.B., Brown University, 1954; Ph.D., University of California at Los Angeles, 1971.

Arnoldy, Roger L. (1967)
Professor of Physics; B.S., St. Mary's College, 1956; M.S., University of Minnesota, 1959; Ph.D., ibid., 1962.

Aronson, Carol (1980)
Assistant Professor of the Arts; B.F.A., Boston University, 1963; M.A., University of Chicago, 1965.

Ashley, Charles H. (1969)
Associate Professor of Education; A.B., Dartmouth College, 1957; M.Ed., University of New Hampshire, 1960; Ed.D., Boston University, 1969.

Ashley, David C. (1980)
Faculty in Residence in Zoology; B.S., Bowling Green State University, 1972; M.S., ibid., 1974; Ph.D., University of Nebraska, 1980.

Baker, Alan L. (1972)
Associate Professor of Botany; B.A., Harpur College, State University of New York, 1965; Ph.D., University of Minnesota, 1973.

Balderacchi, Arthur E. (1965)
Associate Professor of the Arts; A.B., Duke University, 1960; M.F.A., University of Georgia, 1965.

Baldwin, Kenneth C. (1982)
Assistant Professor of Mechanical Engineering; B.S.M.E., Northeastern University, 1973; M.S.M.E., University of New Hampshie, 1977; Ph.D., University of Rhode Island, 1982.

Balling, L. Christian (1967)
Professor of Physics; B.A., Oberlin College, 1960; M.A., Harvard University, 1961; Ph.D., ibid., 1965.

Balomenos, Richard H. (1961)
Professor of Mathematics Education; B.S., United States Merchant Marine Academy, 1952; M.A., New York University, 1956; M.S., University of Notre Dame, 1961; Ed.D., Harvard University, 1961.

Barclay, Angela (1980)
Instructor in Nursing; B.S., Georgetown University, 1966.

Barlow, Robert F. (1962)
Professor of Economics and Administration; B.A., Colby College, 1950; M.A., Fletcher School of Law and Diplomacy, Tufts University, 1951; Ph.D., ibid., 1960.

Barney, Dwight E. (1971)
Thompson School Associate Professor of Applied Animal Science; B.S., University of New Hampshire, 1966; M.S., ibid., 1971.

†Barrett, James P. (1962)
Professor of Forest Biometrics; B.S., North Carolina State University, 1954; M.F., Duke University, 1958; Ph.D., ibid., 1962.

Barstow, Thomas R. (1965)
Assistant Professor of Physical Education; B.S., St. Lawrence University, 1961; M.Ed., ibid., 1965.

Batchelder, Gerald M. (1953)
Thompson School Associate Professor of Civil Technology and Adjunct Associate Professor of Civil Engineering; B.S.C.E., University of New Hampshire, 1950; M.S.C.E., Purdue University, 1952.

Batcheller, Joseph D. (1944)
Professor of Theater and Communication; A.B., Carnegie Institute of Technology, 1936; A.M., University of Minnesota, 1938; Ph.D., ibid., 1942.

Bauer, Christopher F. (1981)
Assistant Professor of Chemistry; B.S., University of Notre Dame, 1974; M.S., University of Illinois, 1976; Ph.D., Colorado State University, 1979.

Baum, William M. (1977)
Associate Professor of Psychology; A.B., Harvard College, 1961; Ph.D., Harvard University, 1966.

Beasley, Wayne M. (1957)
Associate Professor of Materials Science; S.B., Harvard College, 1946; S.M., Massachusetts Institute of Technology, 1965.

Bechtell, Homer F., Jr. (1966)
Professor of Mathematics; B.S., Grove City College, 1951; M.A., University of Wisconsin, 1956; Ph.D., ibid., 1963.

Beck, Robert (1978)
Adjunct Assistant Professor of Medical Technology; A.B., Dartmouth College, 1974; M.D., Johns Hopkins University, 1978.

Befort, William A. (1982)
Assistant Professor of Forest Resources; B.A., University of Minnesota, 1964; B.S., ibid., 1974; M.S., University of Idaho, 1977.

Benassi, Victor A. (1982)
Associate Professor of Psychology; B.S., California State College, 1969; M.A., Queen's College, 1973; Ph.D., City University of New York, 1974.

Bennett, Albert B., Jr. (1967)
Associate Professor of Mathematics; B.S., Maine Maritime Academy, 1954; B.S., University of Maine, 1958; M.A., ibid., 1959; Ed.D., University of Michigan, 1966.

Bergeron, R. Daniel (1974)
Associate Professor of Computer Science; Sc.B., Brown University, 1966; Ph.D., ibid., 1973.

†Berndtson, William E. (1979)
Assistant Professor of Animal Science; B.S., University of Connecticut, 1966; Ph.D., Cornell University, 1971.

Bernier, Raymond J. (1967)
Assistant Professor and Technical Director of Theater and Communication; B.S., Southeastern Massachusetts University, 1958; M.Ed., Bridgewater State College, 1960; M.A., Smith College, 1967.

Bigglestone, Gail A. (1970)
Director of the Department of Women's Intercollegiate Athletics and Assistant Professor of Physical Education; B.S., University of New Hampshire, 1960; M.S., University of Massachusetts, 1965.

Birch, Francis S. (1972)
Associate Professor of Earth Sciences; A.B., Harvard University, 1958; M.S., University of Wisconsin, 1964; Ph.D., Princeton University, 1969.

Bishop, Paul L. (1972)
Professor of Civil Engineering; B.S.C.E., Northeastern University, 1968; M.S.C.E., Purdue University, 1970; Ph.D., ibid., 1972.

Blakemore, Richard P. (1977)
Associate Professor of Microbiology; B.S., State University of New York at Albany, 1964; M.S., ibid., 1965; Ph.D., University of Massachusetts, 1975.

Blanchard, Fletcher A., Jr. (1950)
Professor of Electrical Engineering and Associate Director of Engineering Design and Analysis Lab; B.S., Union College, 1948; M.S., Lehigh University, 1950.

†Blanchard, Robert O. (1972)
Associate Professor of Plant Pathology; B.S., University of Maine at Gorham, 1964; M.Ed., University of Georgia, 1969; Ph.D., ibid., 1971.

Bobick, Melvin T. (1958)
Professor of Sociology; A.B., University of Illinois, 1949; A.M., ibid., 1952; Ph.D., ibid., 1958.

Bogle, A. Linn (1970)
Associate Professor of Botany; B.S., University of Washington, 1958; M.S., ibid., 1961; Ph.D., University of Minnesota, 1968.

Bolian, Charles (1971)
Associate Professor of Anthropology; B.A., Mississippi State University, 1965; Ph.D., University of Illinois, 1975.

Bonnice, William E. (1962)
Associate Professor of Mathematics; B.A.E., Syracuse University, 1951; M.S., University of Washington, 1960; Ph.D., ibid., 1962.

Borror, Arthur C. (1961)
Professor of Zoology; B.S., Ohio State University, 1956; M.S., ibid., 1958; Ph.D., Florida State University, 1961.

Bothner, Wallace A. (1967)
Professor of Geology; B.A., State University of New York at Binghamton, 1963; Ph.D., University of Wyoming, 1967.

Bowes, M. William (1972)
Head Football Coach and Lecturer in Physical Education; B.S., Pennsylvania State University, 1965.

***Bowman, James S.** (1971)
Associate Professor of Entomology and Extension Entomologist; B.Sc., Ohio State University, 1951; M.Sc., ibid., 1954; Ph.D., University of Wisconsin, 1958.

Boy, Angelo V. (1965)
Professor of Education; A.B., University of Notre Dame, 1953; Ed.M., Boston University, 1955; Ed.D., ibid., 1960.

Boynton, Jason E. (1966)
Associate Professor of Education; B.Ed., Plymouth Teachers College, 1949; M.Ed., University of New Hampshire, 1952.

Bozak, John C., Jr. (1967)
Thompson School Associate Professor of Forest Technology; B.S., University of Connecticut, 1962; M.F., Yale School of Forestry, 1963.

Braff, Allan J. (1965)
Associate Professor of Economics; A.B., University of Rochester, 1951; M.B.A., Columbia University, 1953; Ph.D., University of Wisconsin, 1959.

Briggs, Janet C. (1963)
Assistant Professor of Animal Science; B.S., University of Massachusetts, 1962.

Brinck-Johnsen, Trulls (1979)
Adjunct Associate Professor of Medical Technology; Diploma, University of Oslo, 1949; M.S., University of Utah, 1956; Ph.D., ibid., 1959.

Brockelman, Paul T. (1963)
Professor of Philosophy; A.B., Dartmouth College, 1957; M.A., Northwestern University, 1963; Ph.D., ibid., 1968.

Broderick, Dale G. (1974)
Adjunct Associate Professor of Administration; B.S., University of Michigan, 1957; M.B.A., University of Chicago, 1961; Ph.D., Columbia University, 1973.

Bronstein, Arna (1981)
Faculty in Residence in Russian; B.A., Colgate University, 1975; M.A., University of Pennsylvania, 1979.

Brown, Jean M. (1965)
Associate Professor of Theater and Communication; B.A., University of Kentucky, 1956; M.A., Mills College, 1962.

Brown, Philip M. (1981)
Instructor in Social Service; B.A., Michigan State University, 1971; M.S.W., ibid., 1977.

Brown, Roger S. (1974)
Associate Professor of German; A.B., Emory University, 1966; M.A., University of Kansas, 1969; Ph.D., ibid., 1971.

Brown, Warren R. (1972)
Associate Professor of Political Science and Humanities; B.A., Willamette University, 1966; M.A., Claremont Graduate School, 1972; Ph.D., ibid., 1976.

Brown, Wendell S. (1974)
Associate Professor of Earth Sciences; B.S., Brown University, 1965; M.S., ibid., 1967; Ph.D., Massachusetts Institute of Technology, 1971.

Bryce, Jennifer W. (1981)
Assistant Professor of Home Economics; A.B., Smith College, 1975; M.A. Teachers College, Columbia University, 1977; M.Ed., ibid., 1978; Ed.D., ibid., 1980.

Buckley, Walter F. (1971)
Professor of Sociology; B.A., Brown University, 1952; Ph.D., University of Wisconsin, 1958.

Bullock, Wilbur L. (1948)
Professor of Zoology; B.S., Queens College, 1942; M.S., University of Illinois, 1947; Ph.D., ibid., 1948.

†Burger, John F. (1977)
Assistant Professor of Entomology; B.A., Grinnell College, 1962; M.Sc., University of Arizona, 1965; Ph.D., ibid., 1971.

Burns, Carol L. (1969)
Associate Professor of Theater and Communication; B.S., Syracuse University, 1963; Diploma, American Musical and Drama Academy, 1965; M.F.A., University of Utah, 1969.

Burt, John M., Jr. (1974)
Associate Professor of Administration; B.A., Wesleyan University, 1965; M.S., Carnegie-Mellon University, 1967; Ph.D., ibid., 1969.

Burt, Kenneth H. (1977)
Assistant Professor of Electrical Engineering Technology; B.S.E.E., University of New Haven, 1965; M.S.E.E., University of New Hampshire, 1969.

Burton, David M. (1959)
Professor of Mathematics; B.A., Clark University, 1954; A.M., University of Rochester, 1956; Ph.D., ibid., 1961.

†Byers, Gordon L. (1956)
Professor of Soil and Water Science; B.S., MacDonald College, 1948; M.S.A., Ontario Agricultural College, 1950.

***Cady, Roger A.** (1982)
Assistant Professor of Animal Science and Extension Dairyman; B.S., Cornell University, 1974; M.S., ibid., 1977; Ph.D., ibid., 1980.

Calarco, John R. (1981)
Research Associate Professor of Physics; B.S., George Washington University, 1963; M.S., University of Illinois, 1965; Ph.D., ibid., 1969.

Calin, Françoise G. (1982)
Associate Professor of French; Licence de Lettres, University of Paris, 1963; Diplôme d'Etudes Supériéures. ibid., 1964; C.A.P.E.S., ibid., 1966; Ph.D., Stanford University, 1972.

Callan, Richard J. (1969)
Professor of Spanish; A.B., Iona College, 1957; M.A., Fordham University, 1959; Ph.D., St. Louis University, 1965.

Carbonneau, Lionel J. (1965)
Assistant Director of the Department of Men's Intercollegiate Athletics and Assistant Professor of Physical Education; B.A., University of New Hampshire, 1952.

Carlson, Dennis J. (1975)
Adjunct Assistant Professor of Medical Technology; B.A., College of Wooster, 1955; M.D., Western Reserve Medical School, 1959.

Carney, John J. (1973)
Associate Professor of Education; B.A., Seton Hall University, 1963; M.A., ibid., 1967; Ph.D., Syracuse University, 1973.

Carnicelli, Thomas A. (1967)
Professor of English; A.B., Princeton University, 1958; M.A., Harvard University, 1960; Ph.D., ibid., 1966.

Carroll, John E. (1974)
Associate Professor of Environmental Conservation; A.B., Louisiana Technical University, 1966; M.A., Western Michigan University, 1968; Ph.D., Michigan State University, 1974.

Carter, Gavin H. (1965)
Associate Professor of Physical Education; B.S., Springfield College, 1952; M.S., ibid., 1953; Ph.D., University of Oregon, 1958.

Casás, R. Alberto (1952)
Professor of Spanish; B. en L., Universidad de Barcelona, 1936; A.M., Columbia University, 1947; Ph.D., ibid., 1954.

Celikkol, Barbaros (1969)
Associate Professor of Mechanical Engineering; B.A., Elon College, 1964; M.S., Stevens Institute of Technology, 1967; Ph.D., University of New Hampshire, 1972.

Cerny, James W. (1972)
Adjunct Associate Professor of Geography; B.A., University of New Hampshire, 1968; M.S., Pennsylvania State University, 1970; Ph.D., Clark University, 1976.

Chaltas, John G. (1967)
Associate Professor of Education; B.S., Southern Connecticut State University, 1951; M.A., Columbia University, 1953; Ed.D., ibid., 1957.

†Chandler, Donald S. (1981)
Assistant Professor of Entomology and Curator; A.A., Shasta College, 1969; B.S., University of California at Davis, 1971; M.S., University of Arizona, 1973; Ph.D., Ohio State University, 1976.

Chasteen, Margaret H. (1973)
Assistant Professor and Children's and Community Service Librarian; A.B., University of Michigan, Flint College, 1965; M.S., University of Illinois, 1967.

Chasteen, N. Dennis (1972)
Professor of Chemistry; A.S., Flint Junior College, 1962; A.B., University of Michigan 1965; M.S., University of Illinois, 1966; Ph.D., ibid., 1969.

Chen, Jiann-Jer (1972)
Thompson School Associate Professor of Applied Science; B.S., Taiwan Normal University, 1962; M.S., University of New Hampshire, 1968; Ph.D., ibid., 1973.

Chesbro, William R. (1959)
Professor of Microbiology; B.S., Illinois Institute of Technology, 1951; M.S., ibid., 1955; Ph.D., ibid., 1959.

Christie, Andrew (1980)
Instructor in Philosophy; B.A., Princeton University, 1974; M.S.L., Yale Law School, 1978.

Chupp, Edward L. (1962)
Professor of Physics; A.B., University of California at Berkeley, 1950; Ph.D., ibid., 1954.

Cioffi, Grant L. (1980)
Assistant Professor of Education; A.B., Stanford University, 1973; Ph.D., University of Minnesota, 1980.

Clark, Charles E. (1967)
Professor of History; A.B., Bates College, 1951; M.S., Columbia University, 1952; Ph.D., Brown University, 1966.

Clark, Margot (1974)
Associate Professor of the Arts; B.S., Washington University, 1961; M.A., ibid., 1973; Ph.D., ibid., 1974.

Clark, Mary Morris (1978)
Assistant Professor of English; B.A., University of New Hampshire, 1962; Ph.D., University of Massachusetts, 1978.

Clark, Ronald R. (1957)
Professor of Electrical Engineering; B.S., University of New Hampshire, 1956; M.E., Yale University, 1957; Ph.D., Syracuse University, 1963.

Cohn, Ellen S. (1978)
Assistant Professor of Psychology; B.A., Clark University, 1974; M.A., Temple University, 1976; Ph.D., ibid., 1978.

†Collins, Walter M. (1951)
Professor of Animal Science; B.S., University of Connecticut, 1940; M.S., ibid., 1949; Ph.D., Iowa State University, 1960.

†Condon, William C. (1976)
Associate Professor of Animal Science and Reproductive Physiologist; B.A., Merrimack College, 1965; M.S., University of Massachusetts, 1968; Ph.D., ibid., 1975.

Congdon, Robert G. (1952)
Associate Director of Counseling and Adjunct Associate Professor of Psychology; A.B., University of California, 1947; Ed.D., Harvard University, 1961.

Conner, Theodore W. (1962)
Baseball Coach and Assistant Professor of Physical Education; B.S., Springfield College, 1955; M.S., University of Illinois, 1958.

Constantine, Kenneth B. (1981)
Assistant Professor of Mathematics; B.S., Eastern Nazarene College, 1977; M.S., Purdue University, 1979; Ph.D., ibid., 1981.

Conte, Michael A. (1978)
Assistant Professor of Economics; B.A., Yale College, 1970; M.A., University of Michigan, 1976; Ph.D., ibid., 1979.

Coolidge, Clyde R. (1966)
Lecturer in Administration; B.A., University of New Hampshire, 1960; LL.B., Boston College Law School, 1961.

Cooper, Barbara T. (1978)
Assistant Professor of French; B.A., University of Wisconsin at Madison, 1966; M.A., ibid., 1967; Ph.D., ibid., 1974.

Copeland, Arthur H., Jr. (1968)
Professor of Mathematics; B.S., University of Michigan, 1949; M.A., ibid., 1950; Ph.D., Massachusetts Institute of Technology, 1954.

Corcoran, Ellen P. (1972)
Associate Professor of Education; B.A., Bryn Mawr College, 1962; M.A.T., New York University, 1968; Ph.D., ibid., 1972.

Corell, Robert W. (1957-60, 1964)
Director of UNH Marine Program, Director of Sea Grant Program and Professor of Mechanical Engineering; B.S.M.E., Case Institute of Technology, 1956; M.S.M.E., Massachusetts Institute of Technology, 1959; Ph.D., Case Institute of Technology, 1964.

Countway, Sylvia (1978)
Assistant Professor of Medical Technology; Diploma, Mary Hitchcock Memorial Hospital, 1965; B.S., University of New Hampshire, 1965; M.Ed., ibid. 1981.

Cox, Katherine M. (1982)
Faculty in Residence in Administration; B.A., University of New Hampshire, 1976; M.B.A., ibid., 1982.

Craig, Robert E. (1966)
Associate Professor of Political Science; B.A., Adelphi University, 1960; Ph.D., University of North Carolina, 1971.

Crepeau, Elizabeth L. (1981)
Assistant Professor of Occupational Therapy; B.S., University of New Hampshire, 1966.

Croker, Robert A. (1966)
Professor of Zoology; A.B., Adelphi College, 1958; M.S., University of Miami, 1960; Ph.D., Emory University, 1966.

Cronin, Francis J. (1980)
Adjunct Associate Professor of Health Administration and Planning; A.B., George Washington University, 1962; M.B.A., ibid, 1965.

†Crow, Garrett E. (1975)
Associate Professor of Botany; A.B., Taylor University, 1965; M.S., Michigan State University, 1968; Ph.D., ibid., 1974.

Crowell, Susan B. (1982)
Instructor in Nursing; Diploma, Worcester Memorial Hospital, 1976; B.S., Worcester State College, 1980; M.S., Boston College, 1982.

Crow-Seidel, Alice (1976)
Associate Professor of Occupational Therapy, B.S., University of Wisconsin, 1963; M.P.H., University of Michigan, 1971.

Cutler, Linda M. (1979)
Instructor in Nursing; B.S., University of New Hampshire, 1970; M.S., Boston University, 1979.

DaSilva, Jaime (1980)
Faculty in Residence in Spanish; B.A., University of Pennsylvania, 1973; M.A., Harvard University, 1975.

Darlington, Sidney W. (1971)
Adjunct Professor of Electrical Engineering; B.S., Harvard University, 1928; B.S., Massachusetts Institute of Technology, 1929; Ph.D., Columbia University, 1940.

†Darr, Ginny W. (1978)
Assistant Professor of Animal Science; B.A., University of Colorado, 1964; Ph.D., ibid., 1975.

Dauphinais, Edward J. (1968)
Associate Professor and Technology Branch Librarian; B.A., University of Hartford, 1956; M.S.L.S., Simmons College, 1960.

Davenport, Gilbert B. (1962)
Associate Professor of Theater and Communication; B.A., Case Western Reserve University, 1956; Certification, Naval Intelligence School, 1958; M.A., University of Denver, 1961; Ph.D.C., Indiana University, 1970.

Davis, James R. (1970)
Associate Professor of Psychology; B.A., Northern Illinois University, 1965; M.A., ibid., 1966; Ph.D., University of Wisconsin, 1969.

Davis, Myra L. (1945)
Associate Professor of Secretarial Studies; B.S., Central Missouri State Teachers College, 1939; M.A., State University of Iowa, 1945.

Davis, Robert I. (1975)
Adjunct Professor of Geology and New Hampshire State Geologist; B.S., University of New Hampshire, 1947; M.S., University of Michigan, 1949; Ph.D., ibid., 1954.

Dawson, Carl (1970)
Professor of English; A.B., Occidental College, 1959; M.A., Columbia University, 1960; Ph.D., ibid., 1966.

Dawson, John F. (1968)
Professor of Physics; B.S., Antioch College, 1958; Ph.D., Stanford University, 1963.

De Alba, Pedro A. (1977)
Associate Professor of Civil Engineering; C.E., National University of Mexico, 1965; M.E., University of California at Berkeley, 1969; Ph.D., ibid., 1975.

DeMarco, Cecelia (1977)
Head Basketball Coach and Lecturer in Physical Education; B.S., Bridgewater State College, 1973; M.S., Washington State University, 1977.

Demeritt, Maurice E., Jr. (1981)
Adjunct Assistant Professor of Forest Genetics; B.S.F., University of New Hampshire, 1967; M.S., ibid., 1969, Ph.D., Pennsylvania State University, 1977.

†Denis, Clyde L. (1982)
Assistant Professor of Biochemistry; B.S., University of Illinois, 1973; M.S., University of Washington, 1976; Ph.D., ibid., 1982.

Dennett, James (1979)
Adjunct Lecturer in Medical Technology; Diploma, Mary Hitchcock Memorial Hospital, 1979; B.S., University of New Hampshire, 1979.

DePorte, Michael V. (1972)
Professor of English; B.A., University of Minnesota, 1960; M.A., Stanford University, 1964; Ph.D., ibid., 1966.

Desrosiers, Richard V. (1965)
Assistant Professor of Classics; A.B., Boston College, 1960; A.M., University of Wisconsin, 1961; Ph.D., University of North Carolina, 1969.

Diefendorf, Jeffry M. (1976)
Associate Professor of History; A.B., Stanford University, 1967; M.A., University of California at Berkeley, 1968; Ph.D., ibid., 1975.

Diller, Ann L. (1973)
Associate Professor of Education; B.A., Maryville College, 1960; M.A., Tulsa University, 1962; Ed.D., Harvard University, 1971.

Diller, Karl C. (1972)
Professor of English; B.A., University of Pittsburgh, 1961; Ed.M., Harvard University, 1964; Ph.D., ibid., 1967.

†Dingman, S. Lawrence (1975)
Associate Professor of Water Resources; A.B., Dartmouth College, 1960; A.M., Harvard University, 1961; Ph.D., ibid., 1970.

Dishman, Robert B. (1951)
Professor of Political Science; A.B., University of Missouri, 1939; A.M., ibid., 1940; Ph.D., Princeton University, 1948.

Dodge, Peter (1964)
Associate Professor of Sociology; B.A., Swarthmore College, 1948; A.M., Harvard University, 1950; Ph.D., ibid., 1961.

Dolan, Elizabeth M. (1980)
Assistant Professor of Home Economics; B.A., University of California, 1971; M.A., Michigan State University, 1973; Ph.D., Virginia Polytechnic Institute and State University, 1980.

Donovan, Eddylou (1982)
(Captain, U.S. Air Force) Assistant Professor of Aerospace Studies; B.A., Eastern Washington University, 1971; M.B.A., Golden Gate University, 1978.

Downs, Richard E. (1962)
Associate Professor of Anthropology; S.B., Harvard University, 1942; Cert. of Ethn., University of Paris, 1949; Ph.D., University of Leiden, 1956.

Draves, David D. (1964)
Associate Professor of Education; B.A., University of Wisconsin, 1948; M.A., ibid., 1949; Ph.D., ibid., 1957.

Drew, William H. (1956)
Associate Dean of the Graduate School and Professor of Resource Economics; B.S., Pennsylvania State College, 1947; M.S., Rutgers University, 1949; Ph.D., Vanderbilt University, 1961.

Drysdale, Alasdair D. (1976)
Assistant Professor of Geography; B.A., University of Durham, England, 1971; M.A., ibid., 1972; Ph.D., University of Michigan, 1977.

Dubuque, Richard G. (1981)
(Major, U.S. Army) Assistant Professor of Military Science; B.A., Providence College, 1968; M.B.A., Providence College, 1979.

Dunbar, Claire E. (1981)
Assistant Professor in Nursing; Diploma, Johns Hopkins Hospital School of Nursing; B.S.N., Case Western Reserve University, 1968; M.S.N. University of Colorado, 1971.

*†Durgin, Owen B. (1951)
Professor of Resource Economics; B.S.Ed., Gorham State Teachers College, 1946; M.A., University of New Hampshire, 1951.

Durnall, Edward J. (1966)
Director of Division of Continuing Education and Associate Professor of Education; B.S., Hofstra University, 1947; M.A., Colorado College, 1948; Ed.M., Harvard University, 1952; Ed.D., Oregon State University, 1953.

Dusek, R. Valentine (1966)
Associate Professor of Philosophy; B.A., Yale University, 1963; Ph.D., University of Texas, 1972.

East, Linda D. (1979)
Assistant Professor of Spanish; B.A., Carleton College, 1971; M.A., Stanford University, 1975; Ph.D., ibid., 1981.

Echelberger, Herbert L. (1981)
Adjunct Associate Professor of Recreation and Parks; B.S. Southern Illinois University, 1965; M.S., ibid., 1966; Ph.D., State University of New York College of Forestry at Syracuse, 1976.

†Eckert, Robert T. (1978)
Assistant Professor of Forest Genetics; B.S., State University of New York College of Environmental Science and Forestry at Syracuse, 1967; M.S., ibid., 1974; Ph.D., Ohio State University, 1978.

Edwards, John C. (1961)
Professor of Theater and Communication and Director of Theater; B.S., Northwestern University, 1950; M.A., ibid., 1952; Ph.D., ibid., 1963.

Edwards, Ruth S. (1966)
Associate Professor of Music; B.M., Northwestern University, 1949; M.M., ibid., 1950.

*Engalichev, Nicolas (1963)
Professor of Resource Economics and Extension Economist, Specialist, Forest Product Marketing and Utilization; B.S., State University of New York, College of Forestry at Syracuse, 1957; M.S., ibid., 1960.

England, Richard W. (1976)
Associate Professor of Economics; B.A., Oakland University, 1965; M.A., University of Michigan, 1967; Ph.D., ibid., 1974.

Erickson, Raymond L. (1963)
Dean of the Graduate School, Associate Vice President for Academic Affairs and Professor of Psychology; B.A., State University of New York at Buffalo, 1951; M.A., University of California at Los Angeles, 1954; Ph.D., ibid., 1962.

†Estes, George O. (1969)
Professor of Plant Science; B.S., University of Maine, 1958; M.S., ibid., 1960; Ph.D., Oregon State University, 1969.

Etebari, Ahmed (1980)
Assistant Professor of Administration; B.B.A., Teheran Business College, 1973; M.B.A., Texas A & M University, 1975; Ph.D., North Texas State University, 1979.

Eudes, Yves (1982)
Faculty in Residence in Political Science: B.A., Université Paris-VII, 1975; M.A., Université Paris-VIII, 1974; Ph.D., Université Paris-I-Sorbonne, 1981.

Everngam, Michael H. (1979)
(Lt. Colonel, U.S. Army) Professor of Military Science; B.A., Lehigh University, 1963; M.B.A., Georgia State University, 1975.

*†Fairchild, Thomas P. (1969)
Professor of Animal Science; B.S., University of New Hampshire, 1959; M.S., University of Wisconsin, 1961; Ph.D., ibid., 1964.

Fan, Stephen S. T. (1962)
Professor of Chemical Engineering; B.S., Stanford University, 1957; M.S., ibid., 1960; Ph.D., ibid., 1962.

Farag, Ihab H. (1976)
Associate Professor of Chemical Engineering; B.S., Cairo University, Egypt, 1967; M.S., Massachusetts Institute of Technology, 1970; Sc.D., ibid., 1976.

Farber, Florence E. (1981)
Assistant Professor of Microbiology; A.B., Mount Holyoke College, 1961; Ph.D., Columbia University, 1966.

Farwell, Lloyd S. (1981)
Adjunct Professor of Hotel Administration; B.S., University of New Hampshire, 1948.

Federer, C. Anthony (1970)
Adjunct Associate Professor of Micrometeorology; B.S., University of Massachusetts, 1959; M.S., University of Wisconsin, 1962; Ph.D., ibid., 1964.

*†Feltner, Kurt C. (1979)
Dean of the College of Life Sciences and Agriculture, Director of the Agricultural Experiment Station and Professor of Plant Science; B.S., University of Wyoming, 1957; M.S., ibid., 1959; Ph.D., University of Arizona, 1962.

Fernald, Peter S. (1966)
Associate Professor of Psychology; A.B., Amherst College, 1958; M.S., Springfield College, 1959; Ph.D., Purdue University, 1963.

Fink, Stephen L. (1969)
Professor of Organizational Behavior; B.S., Union College, 1954; Ph.D., Case Western Reserve University, 1959.

*†Fisher, G. Thomas (1969)
Associate Professor of Entomology and Extension Entomologist; B.S., Iowa State University, 1950; M.S., Rutgers University, 1952; Ph.D., ibid., 1954.

Fisher, Lester A. (1968)
Assistant Professor of English; B.A., University of Maine, 1966; M.A., University of New Hampshire, 1970; Ph.D., Brown University, 1976.

Fisk, Lennard A., Jr. (1977)
Director of Research and Professor of Physics; A.B., Cornell University, 1965; Ph.D., University of California at San Diego, 1969.

†Fite, Richard W. (1982)
Assistant Professor of Animal Science; B.A., Haverford College, 1970; V.M.D., University of Pennsylvania, 1976.

Fogg, Marguerite F. (1967)
Associate Professor of Nursing; Diploma, Margaret Pillsbury Hospital School, 1940; B.S., Boston College, 1957; M.S., ibid., 1960.

Forbes, F. William (1970)
Associate Professor of Spanish; A.B., Stanford University, 1965; M.A., University of Arizona, 1967; Ph.D., ibid., 1971.

Ford, Carol (1981)
Head Volleyball and Softball Coach and Lecturer in Physical Education; B.S., Central Connecticut State College, 1978.

Ford, Joseph P. (1962)
Assistant Professor of Political Science; B.A., University of New Hampshire, 1956; M.P.A., Harvard University, 1957.

Forest, David A. (1979)
Assistant Professor of Electrical Engineering Technology; B.S.E.E., Northeastern University, 1968; M.S.E.E., ibid., 1974.

Foret, John E. (1967)
Associate Professor of Zoology; A.B., University of New Hampshire, 1962; M.S., ibid., 1963; A.M., Princeton University, 1965; Ph.D., ibid., 1966.

Fort, Marron C. (1969)
Associate Professor of German; A.B., Princeton University, 1961; Ph.D., University of Pennsylvania, 1965.

Francq, Edward N. (1965)
Associate Professor of Zoology; B.S., University of Maryland, 1956; M.S., University of Idaho, 1962; Ph.D., Pennsylvania State University, 1967.

Franzosa, Susan D. (1979)
Assistant Professor of Education; B.A., University of Connecticut, 1968; M.Ed., State University of New York at Buffalo, 1973; Ph.D., ibid., 1979.

French, E. Elizabeth (1972)
Adjunct Associate Professor of Medical Technology; A.B., Skidmore College, 1943; M.T., American Society of Clinical Pathologists, 1944; M.D.C.M., McGill University Faculty of Medicine, 1950.

Freuder, Eugene C. (1977)
Associate Professor of Computer Science; A.B., Harvard University, 1967; Ph.D., Massachusetts Institute of Technology, 1975.

Frick, George E. (1957)
Adjunct Professor of Resource Economics; B.S., University of Connecticut, 1943; M.S., ibid., 1947.

Friel, Gerald J. (1969)
Head Basketball Coach and Lecturer in Physical Education; B.S., State University of New York College at Oswego, 1966.

Frost, Albert D. (1957)
Professor of Electrical Engineering; B.S., Tufts College, 1945; A.M., Harvard University, 1947; Sc.D., Massachusetts Institute of Technology, 1952.

Fuld, Kenneth (1979)
Assistant Professor of Psychology; B.A., Northeastern University, 1971; Ph.D., Dartmouth College, 1976.

Gallagher, Joyce R. (1978)
Adjunct Lecturer in Medical Technology; B.A., Northeastern University, 1971; M.T., American Society of Clinical Pathologists, 1971.

Garber, Richard F., Jr. (1978)
Head Lacrosse Coach, Assistant Soccer Coach and Lecturer in Physical Education; B.S., University of New Hampshire, 1975.

Garrett, Peter W. (1970)
Adjunct Assistant Professor of Forest Genetics; B.S., Michigan State University, 1958; M.S., University of Michigan, 1962; Ph.D., ibid., 1969.

Gass, Michael A. (1981)
Faculty in Residence in Physical Education; B.A., St. Olaf College, 1978; M.A., University of Northern Colorado, 1979.

Gaudard, Marie A. (1977)
Assistant Professor of Mathematics; A.B., Mount Holyoke College, 1973; Ph.D., University of Massachusetts, 1977.

Gaudette, Henri E. (1965)
Professor of Geology; B.A., University of New Hampshire, 1959; M.S., University of Illinois, 1962; Ph.D., ibid., 1963.

Geeslin, William E. (1972)
Associate Professor of Mathematics; B.A., University of Texas at Austin, 1967; M.S., Stanford University, 1970; Ph.D., ibid., 1973.

Gerhard, Glen C. (1967)
Associate Professor of Electrical Engineering; B.E.E., Syracuse University, 1956; M.Sc., Ohio State University, 1958; Ph.D., ibid., 1963.

Gerhard, Gwenyth (1975)
Assistant Professor in Nursing; B.S., Ohio State University, 1959; B.S., University of New Hampshire, 1973; M.S., Boston University, 1977.

Gigley, Helen M. (1982)
Assistant Professor of Computer Science; B.S., University of Cincinnati, 1964; M.S., University of Massachusetts at Amherst, 1969; Ph.D., ibid., 1982.

Gill, Gregory D. (1977)
Assistant Professor of Occupational Education; B.S., Fitchburg State College, 1970; M.Ed., Colorado State University, 1975; Ph.D., ibid., 1977.

Gilmore, Robert C. (1952)
Professor of History; A.B., University of Vermont, 1944; M.A., McGill University, 1947; M.A., Yale University, 1951; Ph.D., ibid., 1954.

Gingras, Rene J. (1980)
Thompson School Assistant Professor of Horticultural Technology; B.S., University of New Hampshire, 1975; M.S., Virginia Polytechnic Institute and State University, 1977.

Glanz, Filson H. (1965)
Associate Professor of Electrical Engineering; B.S., Stanford University, 1956; M.S., ibid., 1957; Ph.D., ibid., 1965.

Goldminz, Esther (1982)
Instructor of Psychology; B.A., Hebrew University of Jersusalem, 1970; M.A., ibid., 1973.

Goodman, Richard H. (1976)
Director of the Center for Educational Field Services and Adjunct Associate Professor of Education, Executive Director of the New Hampshire School Boards Association and Executive Director of the New Hampshire School Administrators Association; B.A., Dartmouth College, 1953; M.A.T., Wesleyan University, 1955; Ed.D., Harvard University, 1961.

Goodman, Raymond J., Jr. (1982)
Associate Professor of Hotel Administration; B.B.A., Southwest Texas State University, 1967; M.P.S., Cornell University, 1975; Ph.D., ibid., 1979.

Goodspeed, Charles H. (1978)
Associate Professor of Civil Engineering; B.S.C.E., Worcester Polytechnic Institute, 1967; M.S.C.E., ibid., 1969; Ph.D., University of Cincinnati, 1972.

Goodspeed, Gail A. (1979)
Head Gymnastics Coach and Lecturer in Physical Education; B.S., Springfield College, 1974; M.S., ibid., 1975.

Goodwin, Paul (1979)
Instructor in Theater and Communication; B.A., University of Arkansas, 1972; M.A., University of Illinois at Urbana, 1974.

Gordon, Bernard K. (1971)
Professor of Political Science; B.A., New York University, 1953; A.M., ibid., 1955; Ph.D., University of Chicago, 1959.

Grant, Clarence L. (1952)
Professor of Chemistry; B.S., University of New Hampshire, 1951; M.S., ibid., 1956; Ph.D., Rutgers University, 1960.

Graulich, Melody G. (1978)
Assistant Professor of English; B.A., Stanford University, 1974; M.A., University of Virginia, 1975, Ph.D., ibid., 1979.

Graves, Donald H. (1973)
Professor of Education; B.A., Bates College, 1952; M.Ed., Bridgewater State College, 1959; Ed.D., State University of New York at Buffalo, 1973.

†Green, Donald M. (1967)
Professor of Biochemistry; A.B., Oberlin College, 1954; Ph.D., University of Rochester, 1958.

Gress, David L. (1974)
Assistant Professor of Civil Engineering; B.S., Purdue University, 1966; M.S., ibid., 1968; Ph.D., ibid., 1976.

Haaland, Gordon A. (1965-74, 1979)
Vice President for Academic Affairs and Professor of Psychology; A.B., Wheaton College, 1962; Ph.D., State University of New York at Buffalo, 1966.

Hadwin, Donald W. (1977)
Associate Professor of Mathematics; B.S., Michigan State University, 1967; M.A., University of Wisconsin, 1968; Ph.D., Indiana University, 1975.

Hageman, Elizabeth H. (1971)
Associate Professor of English; B.S., Simmons College, 1963; M.A., Columbia University, 1964; Ph.D., University of North Carolina, 1971.

Hagstrom, Earl C. (1965)
Associate Professor of Psychology; B.S., Tufts University, 1952; Sc.M., Brown University, 1954; Ph.D., ibid., 1957.

Haley, Russell I. (1975)
Professor of Marketing; A.B., College of Wooster, 1946; M.B.A., Columbia University, 1948; Ph.D., Union Graduate School, 1974.

Hall, Francine S. (1980)
Assistant Professor of Administration; B.A., Boston University, 1965; M.S., Southern Connecticut State College, 1968; Ph.D., University of Toronto, 1975.

†Hall, Francis R. (1964)
Professor of Hydrology; B.S., Stanford University, 1949; M.A., University of California at Los Angeles, 1953; Ph.D., Stanford University, 1961.

Hamilton, Lawrence C. (1977)
Assistant Professor of Sociology; B.A., University of California at Santa Barbara, 1970; M.A., University of Colorado, 1974; Ph.D., ibid., 1978.

Handler, Evelyn E. (1980)
President and Professor of Zoology; B.A., Hunter College, 1954; M.Sc., New York University, 1962; Ph.D., ibid., 1963.

Haney, James F. (1972)
Associate Professor of Zoology; A.B., Miami University, 1961; M.A., ibid., 1963; Ph.D., University of Toronto, 1970.

Hansen, Jane A. (1979)
Assistant Professor of Education; B.S., Drake University, 1964; M.A., University of Iowa, 1976; Ph.D., University of Minnesota, 1979.

Hansen, Larry J. (1973)
Associate Professor of Home Economics; B.S., Brigham Young University, 1968; M.S., ibid., 1971; Ph.D., Florida State University, 1973.

Hansen, Nancy L. (1982)
Faculty in Residence in Administration; B.S., Boston University, 1966; M.B.A., Boston College, 1982.

Hapgood, Robert (1965)
Professor of English; B.A., University of California, 1950; M.A., ibid., 1951; Ph.D., ibid., 1955.

Harel, Dov (1980)
Assistant Professor of Computer Science; B.S., Hebrew University of Jerusalem, 1973; M.S., ibid., 1976; M.S., University of California at Irvine, 1978; Ph.D., ibid., 1980.

Harris, F. Conley (1970)
Associate Professor of the Arts; B.F.A., University of Kansas, 1965; M.F.A., University of Wisconsin, 1968.

Harris, Larry G. (1969)
Associate Professor of Zoology; A.B., University of California, 1965; Ph.D., ibid., 1970.

Hart, Reina P. (1970)
Associate Professor and Assistant Reference Librarian; B.A., University of New Hampshire, 1963; M.A., ibid., 1969; M.S., Simmons College, 1973.

†Harter, Robert D. (1969)
Associate Professor of Soil Chemistry; B.S., Ohio State University, 1961; M.S., ibid., 1962; Ph.D., Purdue University, 1966.

Hartwell, Judith B. (1980)
Faculty in Residence in Theater and Communication; B.A., California State University, 1972; M.A., ibid., 1973; J.D., Franklin Pierce Law Center, 1979.

Hatch, John W. (1949)
Professor of the Arts; Diploma, Massachusetts School of Art, 1941; B.F.A., Yale University School of the Fine Arts, 1948; M.F.A., ibid., 1949.

Havsky, Audrey A. (1979)
Assistant Professor of Music; B.M., Syracuse University, 1949; M.S.M., Union Theological Seminary, 1951.

Hebert, David J. (1967)
Associate Professor of Education; B.S., University of Maine, 1962; M.Ed., Duquesne University, 1964; Ph.D., Kent State University, 1967.

***Heckel, Maynard C.** (1971)
Associate Dean of the College of Life Sciences and Agriculture, Director of Cooperative Extension, and Professor of Adult Education; B.S., Rutgers University, 1949; M.S., Cornell University, 1956; Ed.D., ibid., 1961.

Heidgerd, Lloyd H. (1969)
Associate Professor and Biology Branch Librarian; A.B., Oberlin College, 1941; M.A., Teachers College, Columbia University, 1948; Ed.D., University of Illinois, 1958; A.M.L.S., University of Michigan, 1969.

Heilbronner, Hans (1954)
Professor of History; A.B., University of Michigan, 1949; A.M., ibid., 1950; Ph.D., ibid., 1954.

Heisenberg, Jochen (1978)
Professor of Physics; Vordiplom, University of Munich, 1961; Diplom, University of Hamburg, 1964; Doctor, ibid., 1966.

Held, Warren H., Jr. (1967)
Professor of Classics; B.A., Princeton University, 1950; M.A., Yale University, 1952; Ph.D., ibid., 1955.

Helies, Frank C., Jr. (1976)
Swim Coach and Lecturer in Physical Education; B.S., Trenton State College, 1971; M.Ed., ibid., 1973.

Hennessey, Barry J. (1979)
Assistant Professor and Head, Cataloging Department; A.B., University of Wisconsin, 1967; Ph.D., Harvard University, 1972; M.L.S., Simmons College, 1974.

Henry, Robert M. (1980)
Assistant Professor of Civil Engineering; B.S.C.E., University of Pennsylvania, 1973; M.S.C.E., University of Pennsylvania, 1974; Ph.D., ibid., 1980.

Herbel, Leroy A., Jr. (1982)
(Captain, U.S. Army) Assistant Professor of Military Science; B.S., Southwest Missouri State University, 1976; M.Ed., Georgia Southern College, 1978.

†Herbst, Edward J. (1962)
Professor of Biochemistry; B.S., University of Wisconsin, 1942; M.S., ibid., 1944; Ph.D., ibid., 1949.

Herold, Marc W. (1975)
Associate Professor of Economics; B.S., Swiss Federal Polytechnic University, 1967; M.B.A., University of California at Berkeley, 1970; Ph.D., ibid., 1977.

Hettinger, Stanley D. (1965)
Associate Professor of Music and Band Director; B.M., Ohio State University, 1955; M.M.E., Vandercook College, 1966.

†Hill, John L. (1964)
Professor of Wood Science and Technology; B.S.F., Colorado State University, 1942; M.S.F., Yale University, 1947; D.F., ibid., 1954.

Hiller, Marc D. (1979)
Assistant Professor of Health Administration and Planning; B.S., University of Pittsburgh, 1972; M.P.H., ibid., 1974; Dr.P.H., ibid., 1978.

Hochgraf, Frederick G. (1958)
Associate Professor of Materials Science; B.Met.E., Rensselaer Polytechnic Institute, 1954; M.S., Cornell University, 1958.

†Hocker, Harold W., Jr. (1955)
Professor of Forest Resources; B.S.F., Pennsylvania State College, 1949; M.F., North Carolina State College, 1952; D.F., Duke University, 1955.

Hoff, Phyllis A. (1967)
Associate Professor of Physical Education; B.S., University of Texas, 1957; M.S., Smith College, 1960; Ph.D., University of Southern California, 1967.

Holland, Darcy P. (1979)
Director of Athletic Training Program and Part-time Instructor in Physical Education; A.A., Colby-Sawyer College, 1965; B.A., Ohio Wesleyan University, 1967; M.A., Indiana State University, 1977.

Hollweg, Joseph (1980)
Research Associate Professor of Physics, B.S., Massachusetts Institute of Technology, 1965; M.S., ibid., 1965; Ph.D., ibid., 1968.

†Holter, James B. (1963)
Professor of Animal Science; B.S., Pennsylvania State University, 1956; M.S., University of Maryland, 1958; Ph.D., Pennsylvania State University, 1962.

Hood, Craig A. (1981)
Faculty in Residence in the Arts; B.A., Pennsylvania State University, 1979; M.F.A., Indiana University, 1981.

Hoornbeek, Frank K. (1964)
Professor of Zoology; B.S., Oregon State College, 1952; M.S., Oregon State University, 1962; Ph.D., ibid., 1964.

Hopkins, Martha (1982)
Assistant Professor of Medical Technology; Diploma, Mary Hitchcock Memorial Hospital, 1965; B.A., University of New Hampshire, 1964; M.S., Rivier College, 1978.

Hornbeck, James W. (1969)
Adjunct Associate Professor of Forest Hydrology; B.S., Pennsylvania State University, 1960; M.S., ibid., 1962; Ph.D., State University of New York College of Environmental Science and Forestry at Syracuse, 1973.

Horrigan, James O. (1966)
Professor of Administration; B.A., University of Notre Dame, 1952; M.B.A., University of Chicago, 1956; Ph.D., ibid., 1967.

Houston, Robert E., Jr. (1957)
Professor of Physics; B.S., Michigan State University, 1949; M.S., ibid., 1951; Ph.D., Pennsylvania State University, 1957.

Howard, Cleveland L. (1969)
Associate Professor of Music; B.Mus., Boston University, 1953; M.M., ibid., 1954; D.M.A., ibid., 1969.

†Howard, Theodore E. (1981)
Assistant Professor of Forest Economics; B.S., University of Maine, 1972; M.F, Duke University, 1974.

Howell, David L. (1982)
Assistant Professor of Occupational Education; B.S., Michigan State University, 1964; M.Ed., Pennsylvania State University, 1968; Ph.D., Ohio State University, 1973.

Howell, W. Huntting (1980)
Assistant Professor of Zoology; B.A., Otterbein College, 1969; M.S., University of Rhode Island, 1975; Ph.D., ibid., 1980.

Hoyle, Elizabeth L. (1977)
Thompson School Assistant Professor of Food Services Management; B.S., Carnegie-Mellon University, 1956; M.O.E., University of New Hampshire, 1977.

Hoyle, Merrill C. (1972)
Adjunct Assistant Professor of Plant Science; B.S., University of Massachusetts, 1957; M.S., ibid., 1961; Ph.D., University of New Hampshire, 1971.

Hubbard, Colin D. (1967)
Professor of Chemistry; B.Sc., University of Sheffield, 1961; Ph.D., ibid., 1964.

Hudon, Louis J. (1961)
Professor of French; A.B., Bowdoin College, 1938; M.A., Yale University, 1942; Ph.D., ibid., 1943.

Hull, John J. (1967)
Assistant Professor and Assistant Acquisitions/ Serials Librarian; B.A., University of New Hampshire, 1947; M.Ed., ibid., 1967; M.S., Simmons College, 1975.

Hunt, Leslie J. (1981)
Assistant Professor of Music; B.S., University of Connecticut, 1969; M.A., ibid., 1976; Ph.D., Indiana University, 1982.

Hurd, Richard W. (1973)
Associate Professor of Economics; B.A., Florida State University, 1968; Ph.D., Vanderbilt University, 1972.

†Hylton, Walter E. (1976)
Associate Professor of Animal Science; B.S., Virginia Polytechnic Institute, 1966; V.M.D., University of Pennsylvania, 1970.

†Ikawa, Miyoshi (1963)
Professor of Biochemistry; B.S., California Institute of Technology, 1941; M.S., University of Wisconsin, 1944; Ph.D., ibid., 1948.

Irish, James D. (1979)
Research Associate Professor of Earth Sciences; B.S., Antioch College, 1967; M.S., University of California at San Diego, 1969; Ph.D., ibid., 1971.

Irwin, Manley R. (1963)
Professor of Economics and Administration; A.B., Michigan State College, 1950; M.A., University of Michigan, 1954; Ph.D., Michigan State University, 1963.

Jacobs, Katherine J. (1981)
Faculty in Residence in Theater and Communication; B.A., University of North Dakota, 1972; M.A., ibid., 1980; M.F.A., Tulane University, 1981.

Jacoby, A. Robb (1961)
Professor of Mathematics; S.B., University of Chicago, 1941; S.M., ibid., 1942; Ph.D., ibid., 1946.

†Jahnke, Leland S. (1977)
Associate Professor of Botany; B.A., University of Minnesota, 1961; M.A., ibid., 1966; M.S., ibid., 1968; Ph.D., ibid., 1973.

James, Marion E. (1955)
Associate Professor of History; A.B., University of New Hampshire, 1940; A.M., Harvard University, 1949; Ph.D., ibid., 1955.

†Jansen, Edmund F., Jr. (1969)
Professor of Resource Economics; B.S., University of Illinois, 1960; M.S., North Carolina State University, 1964; Ph.D., ibid., 1966.

Janson, Colette H. (1981)
Assistant Professor of Animal Science and Nutrition; B.S., Bridgewater State College, 1967, M.S., University of New Hampshire, 1970; Ph.D., ibid., 1980.

Jarest, Jackie L. (1980)
Faculty in Residence in Spanish; B.A., University of Massachusetts, 1976; M.A., University of Kansas, 1979.

Jellison, Charles A., Jr. (1956)
Professor of History; A.B., Stanford University, 1947; M.A., ibid., 1948; Ph.D., University of Virginia, 1956.

Jenkins, Melvin E., Jr. (1961)
Thompson School Professor of Forest Technology; B.S.F., University of Massachusetts, 1959; M.S.F., University of New Hampshire, 1961.

Jenks, R. Stephen (1967)
Adjunct Professor of Organizational Behavior; B.A., College of Wooster, 1961; M.S., Case Western Reserve University, 1963; Ph.D., ibid., 1966.

Johnson, Brian L. (1981)
Faculty in Residence in Computer Science; B.S., University of New Hampshire, 1967; M.S., ibid., 1979.

Johnson, Gary R. (1978)
Thompson School Assistant Professor of Horticultural Technology; A.A., Sauk Valley College, 1968; B.S., Western Illinois University, 1970; M.S., ibid., 1977.

†Johnson, Paul C. (1979)
Assistant Professor of Entomology; B.S., Emory and Henry College, 1968; Ph.D., Cornell University, 1974.

Jolley, Robert E. (1979)
Instructor in Social Service; B.A., Allegheny College, 1966; M.S.S.S., Boston University School of Social Work, 1972.

Jones, Galen E. (1966)
Professor of Microbiology; B.A., Dartmouth College, 1950; M.A., Williams College, 1952; Ph.D., Rutgers University, 1956.

Jones, Paul R. (1956)
Professor of Chemistry; A.B., Albion College, 1952; Ph.D., University of Illinois, 1956.

Jones, William R. (1962)
Professor of History; A.B., Harvard University, 1951; M.A., ibid., 1952; Ph.D., ibid., 1958.

Kaen, Fred R. (1973)
Associate Professor of Finance; B.S., Lehigh University, 1963; M.B.A., University of Michigan, 1967; Ph.D., ibid., 1972.

Kagan, Richard A. (1981)
Faculty in Residence in Political Science; B.A., Indiana University, 1970; Ph.D., City University of New York, 1980.

Kalinowski, Michael F. (1980)
Assistant Professor of Home Economics; B.A., Bennington College, 1970; M.Ed., University of Massachusetts, 1972; Ed.D., ibid., 1976.

Kamakaris, Richard G. (1980)
(Captain, U.S. Army) Assistant Professor of Military Science; B.A., Alfred University, 1973; M.S., University of Cincinnati, 1975.

Kapoor, Jagdish C. (1975)
Assistant Professor and Monographs Order Librarian; B.A., Punjab University, 1946; M.A., ibid., 1954; M.A., University of New Hampshire, 1969; M.S., Simmons College, 1974.

Kaufman, Richard J. (1977)
Assistant Professor of Social Service; B.A., University of California at Berkeley, 1965; M.S., Boston University School of Social Work, 1971; Ph.D., Brandeis University, 1976.

Kaufmann, Richard L. (1963)
Professor of Physics; B.S., California Institute of Technology, 1957; M.S., Yale University, 1958; Ph.D., ibid., 1960.

Kayser, John R. (1969)
Associate Professor of Political Science; B.A., University of New Hampshire, 1962; M.A., Ohio State University, 1964; Ph.D., Claremont Graduate School and University Center, 1969.

Keesey, C. Robert (1960)
Assistant to the President for Administrative Affairs; B.A., Oberlin College, 1948.

Kelley, Ann (1965)
Associate Professor of Nursing; Diploma, Peter Bent Brigham Hospital, 1955; B.S., Boston University, 1959; M.S., ibid., 1966.

Kennard, Jean E. (1975)
Professor of English; B.A., University of London, 1958; M.A., University of California at Berkeley, 1966; Ph.D., ibid., 1968.

Kertzer, Robert (1965)
Associate Professor of Physical Education; B.S., Brooklyn College, 1960; M.S., University of Illinois, 1961; Ph.D., Michigan State University, 1965.

Khleif, Bud B. (1967)
Professor of Sociology; Intermediate Certificate, British Government Arab College, Jerusalem, 1948; B.A., Hebrew University, 1952; M.A., University of Michigan, 1954; Ph.D., Johns Hopkins University, 1957.

†Kiang, Yun-Tzu (1970)
Associate Professor of Plant Science and Genetics; B.S., Taiwan Normal University, 1957; M.A., Ohio State University, 1962; Ph.D., University of California, 1970.

Kies, Christopher (1979)
Assistant Professor of Music; B.M. Composition and B.M. Piano, New England Conservatory of Music, 1973; M.F.A., Brandeis University, 1977.

Kimball, Robert O. (1946)
Associate Professor of Mathematics; B.S., University of New Hampshire, 1941; M.A., ibid., 1952.

Kimball, Roland B. (1963)
Professor of Education; B.S., University of New Hampshire, 1942; M.Ed., ibid., 1949; Ed.D., Harvard University, 1958.

Klotz, Louis H. (1965)
Associate Professor of Civil Engineering; B.S.C.E., Pennsylvania State University, 1951; M.S.C.E., New York University, 1956; Ph.D., Rutgers University, 1967.

†Koch, David W. (1971)
Associate Professor of Plant Science; B.S., Kansas State University, 1964; M.S., ibid., 1966; Ph.D., Colorado State University, 1971.

Kole, Michael E. (1977)
Assistant Professor of Administration; B.Mgt.Eng., Rensselaer Polytechnic Institute, 1960; Ph.D., University of Massachusetts, 1978.

Komonchak, Bernadette (1976)
Associate Professor of Spanish; B.S., State University of New York at Plattsburgh, 1954; M.A., University of Arizona, 1967; Ph.D., ibid., 1974.

Korbel, John J. (1966)
Professor of Economics and Administration; S.B., Harvard College, 1939; M.B.A., Harvard Business School, 1941; Ph.D., Harvard University, 1959.

Kottmeyer, Mary Ellen (1981)
Adjunct Lecturer in Medical Technology; B.S., University of Massachusetts, 1965; M.S., University of Vermont, 1976.

Kraft, L. Gordon (1978)
Assistant Professor of Electrical Engineering; B.S., University of Pennsylvania, 1971; M.S., University of New Hampshire, 1973; Ph.D., University of Connecticut, 1977.

Krueger, Nancy L. (1979)
Head Cross Country and Track and Field Coach and Lecturer in Physical Education; B.S., Bemidji State College, 1973; M.S., Washington State University at Pullman, 1976.

Kull, Judith A. (1982)
Faculty in Residence in Education; A.B., Connecticut College, 1967; M.A., University of Southern Florida, 1969; Ed.D., University of Rochester, 1982.

Kuo, Shan S. (1964)
Professor of Computer Science; B.S., National Chung Chen University, 1944; M.S., Ohio State University, 1948; M.E., Harvard University, 1954; D.Eng., Yale University, 1958.

LaBay, Duncan G. (1980)
Assistant Professor of Administration; B.S., Tufts University, 1973; B.A., University of Southern Maine, 1974; M.A., Tufts University, 1976; Ph.D., University of Michigan, 1979.

LaCourse, John R. (1980)
Assistant Professor of Electrical Engineering; B.S., University of Connecticut, 1974; M.S., ibid., 1977; Ph.D., ibid., 1981.

LaCroix, Karol A. (1972)
Associate Professor of Medical Technology; Diploma, Mary Hitchcock Memorial Hospital, 1967; B.S., University of New Hampshire, 1967; M.Ed., ibid., 1975; M.S., Northeastern University, 1982.

Ladd, Dwight R. (1964)
Dean of Whittemore School of Business and Economics and Professor of Administration; A.B., Brown University, 1943; M.B.A., Harvard University, 1949; D.B.A., ibid., 1956.

Laird, Jo (1979)
Assistant Professor of Geology; B.A., University of California at San Diego, 1969; Ph.D., California Institute of Technology, 1977.

Lamb, Richard (1980)
Visiting Assistant Professor of Administration; A.B., St. Anselm College, 1961; M.Ed., State College at Boston, 1965; M.B.A., Suffolk University, 1971.

Lambert, Robert H. (1955-56, 1961)
Professor of Physics; B.S., St. Lawrence University, 1952; M.A., Harvard University, 1954; Ph.D., ibid., 1963.

LaPage, Wilbur F. (1973)
Adjunct Professor of Recreation and Parks; B.S., University of New Hampshire, 1960; M.S., ibid., 1962; Ph.D., Syracuse University, 1975.

Larson, Barbara K. (1976)
Assistant Professor of Anthropology; B.A., Stanford University, 1962; M.A., Harvard University, 1964; Ph.D., Columbia University, 1975.

Larson, David L. (1965)
Associate Professor of Political Science; A.B., Dartmouth College, 1952; A.M., Fletcher School, Tufts University, 1957; M.A.L.D., ibid., 1958; Ph.D., ibid., 1963.

Laurent, John L. (1954)
Professor of the Arts; B.F.A., Syracuse University, 1948; M.A.T., Indiana University, 1954.

Lavoie, Marcel E. (1950-52, 1955)
Associate Professor of Zoology; B.A., St. Anselm's College, 1940; M.S., University of New Hampshire, 1952; Ph.D., Syracuse University, 1956.

Leahy, John A., Jr. (1966)
Assistant to the Director of the Thompson School of Applied Science and Thompson School Assistant Professor of Horticultural Technology; B.S., University of New Hampshire, 1947; M.S., ibid., 1971.

Leak, William B. (1967)
Adjunct Associate Professor of Forest Resources; B.S., State University of New York College of Forestry at Syracuse, 1953; M.F., ibid., 1956.

Leary, David E. (1976)
Associate Professor of Psychology; B.A., San Luis Rey College, 1968; M.A., San Jose State College, 1972; Ph.D., University of Chicago, 1977.

Leatherbee, Karen C. (1982)
Lecturer in Nursing; B.S.N., University of Southern Maine, 1977; M.S., Boston College, 1982.

LeBlanc, Robert G. (1963)
Associate Professor of Geography; B.A., University of New Hampshire, 1959; M.A., University of Minnesota, 1962; Ph.D., ibid., 1968.

LeClair, Arthur B., Jr. (1981)
Thompson School Instructor in Horticultural Technology; B.S., University of New Hampshire, 1980.

†Lee, Thomas D. (1980)
Assistant Professor of Botany; B.S., State University of New York College of Environmental Science and Forestry at Syracuse, 1973; M.S., University of Alberta, 1976; Ph.D., University of Illinois at Urbana, 1980.

Leighton, Charles H. (1956)
Professor of Spanish; A.B., Harvard College, 1951; A.M., Harvard University, 1953; Ph.D., ibid., 1961.

LeRay, Nelson L., Jr. (1966)
Adjunct Professor of Resource Economics; B.S., Louisiana State University, 1952; M.A., ibid., 1953; Ed.D., Cornell University, 1965.

Lerch, Barbara A. (1982)
Associate Professor and Loan Librarian; B.A., University of Maine, 1969; M.L.S., University of Pittsburgh, 1972; M.A., University of New Hampshire, 1982.

Lethbridge, Dona J. (1981)
Assistant Professor in Nursing; Diploma, Royal Columbian Hospital School of Nursing, British Columbia, 1971; B.S.N., University of British Columbia, 1976; M.A., New York University, 1979.

Lewis, Frederick C. (1976)
Associate Professor of Communication Disorders; B.S., Southern Connecticut State College, 1963; M.S., ibid., 1967; Ph.D., Ohio University, 1970.

Lewis, Richard J. A. (1982)
Assistant Professor of Health Administration and Planning; B.A., Allegheny College, 1961; M.B.A., Ohio State University, 1967.

Licciardello, Gail J. (1980)
Assistant Professor of Occupational Therapy; B.S., Boston University, 1973; M.P.A., American University, 1980.

Lichtenstein, Stephen (1980)
Instructor of Occupational Education; A.A.S., State University of New York Agricultural and Technical College at Cobleskill, 1973; B.S., Cornell University, 1975; M.S., ibid., 1979.

Lieber, Rochelle (1981)
Assistant Professor of English; A.B., Vassar College, 1976; Ph.D., Massachusetts Institute of Technology, 1980.

Limber, John E. (1971)
Associate Professor of Psychology; B.S., University of Illinois at Urbana, 1962; Ph.D., ibid., 1969.

Limbert, David E. (1969)
Associate Professor of Mechanical Engineering; B.S., Iowa State University, 1964; M.S., Case Western Reserve University, 1965; Ph.D., ibid., 1969.

Lindberg, Gary H. (1974)
Professor of English; B.A., Harvard University, 1963; M.A., Stanford University, 1966; Ph.D., ibid., 1967.

Linden, Allen B. (1963)
Associate Professor of History; B.A., Wayne State University, 1957; M.A., Columbia University, 1960; Ph.D., ibid., 1969.

†Lindsay, Bruce E. (1976)
Associate Professor of Resource Economics; B.A., King's College, 1971; M.S., University of Massachusetts, 1973; Ph.D., ibid., 1976.

Linsky, Arnold S. (1966)
Professor of Sociology; A.B., Dartmouth College, 1954; M.A., University of Washington, 1963; Ph.D., ibid., 1966.

Littlefield, Karen A. (1964)
Assistant Professor and Children's and Community Services Librarian; B.A., University of New Hampshire, 1963; M.S., Simmons College, 1965; M.A., University of New Hampshire, 1971.

Lockwood, John A. (1948)
Professor of Physics; A.B., Dartmouth College, Thayer School of Engineering, 1941; M.S., Lafayette College, 1943; Ph.D., Yale University, 1948.

Loder, Theodore C., III (1972)
Associate Professor of Earth Sciences; B.A., University of Rochester, 1962; M.S., Lehigh University, 1965; Ph.D., University of Alaska, 1971.

Logan, Terence P. (1968)
Professor of English; A.B., Boston College, 1959; M.A., University of Wisconsin, 1961; Ph.D., Harvard University, 1966.

Long, David F. (1948)
Professor of History; A.B., Dartmouth College, 1939; A.M., Columbia University, 1948; Ph.D., ibid., 1950.

†Loy, J. Brent (1967)
Professor of Plant Science; B.S., Oklahoma State University, 1963; M.S., Colorado State University, 1965; Ph.D., ibid., 1967.

Lubow, Neil B. (1974)
Associate Professor of Philosophy; A.B., Cornell University, 1966; C. Phil., University of California at Los Angeles, 1973; Ph.D., ibid., 1974.

Lucas, Roberta N. (1982)
Faculty in Residence in Spanish; B.A., University of Maine at Orono, 1969; M.A., University of Arizona, 1977.

†Luloff, Albert E. (1977)
Associate Professor of Community Development; B.S., Cornell University, 1971; M.S., North Carolina State University, 1974; Ph.D., Pennsylvania State University, 1977.

Lumsden, Abigail R. (1974)
Lecturer in Zoology; B.S., University of Maine, 1968; M.S., ibid., 1974.

Lynch, Kathryn B. (1981)
Instructor in Nursing; Diploma, Albany Medical Center, 1973; B.S.N., Northeastern University, 1977; M.S.N., University of Virginia, 1980.

Lyons, Harvey (1981)
Associate Professor of Mechanical Engineering; Certification in Industrial Design, Pratt Institute, 1952; B.S., Cooper Union, 1962; M.E., ibid., 1971; Ph.D., Ohio State University, 1978.

Lyons, Judith T. (1979)
Instructor in Nursing; Diploma, Jersey City Medical Center, 1963; B.S.N., Lowell State College, 1973; M.S., ibid., 1977; M.Ed.Adm., Rivier College, 1978.

Lyons, William Berry (1980)
Assistant Professor of Earth Sciences; A.B., Brown University, 1969; M.S., University of Connecticut, 1972; Ph.D., ibid., 1979.

***†MacHardy, William E.** (1972)
Associate Professor of Plant Pathology and Extension Plant Pathologist; B.S., University of Maine, 1958; M.Ed., ibid., 1965; M.S., University of Nebraska at Omaha, 1966; Ph.D., University of Rhode Island, 1970.

Magidson, David J. (1972)
Associate Professor of Theater and Communication; B.S., University of Wisconsin, 1963; M.S., ibid., 1965; Ph.D., University of Utah, 1969.

Mallory, Bruce L. (1979)
Assistant Professor of Education; B.A., Allegheny College, 1971; M.Ed., ibid., 1972; Ph.D., George Peabody College, 1979.

Mann, G. Roy, Jr. (1980)
Assistant Professor of Music; M.M. Violin, University of Texas, 1973.

March, Thomas A. (1977)
Thompson School Associate Professor of Agricultural Mechanization; B.S., Cornell University, 1974; M.P.S., ibid., 1977.

Marshall, Grover E. (1965)
Assistant Professor of French and Italian; A.B., Bowdoin College, 1951; M.A., Princeton University, 1954; Ph.D., ibid., 1971.

Martin-Diaz, Richard (1979)
Associate Professor of Administration; B.A., Inter-American University, 1970; M.B.A., Rutgers Graduate School of Business, 1972; Ph.D., Syracuse University, 1974.

Mathieson, Arthur C. (1965)
Professor of Botany; B.A., University of California, 1960; M.A., ibid., 1961; Ph.D., University of British Columbia, 1965.

Mathur, Virendra K. (1974)
Associate Professor of Chemical Engineering; B.S., Banaras University, India, 1953; M.S., University of Missouri at Rolla, 1961; Ph.D., ibid., 1970.

†Matthew, James B. (1982)
Assistant Professor of Biochemistry; B.S., Pennsylvania State University, 1973; Ph.D., Indiana University, 1978.

†Mautz, William W. (1969)
Professor of Wildlife Ecology; B.S., Wisconsin State University, 1965; M.S., Michigan State University, 1967; Ph.D., ibid., 1969.

Mayewski, Paul A. (1974)
Associate Professor of Earth Sciences; B.A., State University of New York at Buffalo, 1968; Ph.D., Ohio State University, 1973.

Mayewski, Sandi F. (1979)
Instructor in Russian; B.A., State University of New York at Buffalo, 1969; M.A., Ohio State University, 1972.

Mazza, Karen A. (1980)
Assistant Professor of Education; B.A., Utica College, 1969; M.S., State University of New York at Cortland, 1975; Ed.D., Boston University, 1980.

McBride, Mekeel (1979)
Assistant Professor of English; B.A., Mills College, 1972.

McCann, Diane M. (1981)
Assistant Professor of Nursing; B.S.N., Niagara University, 1962; M.S.N., Boston University, 1981.

McCann, Francis D., Jr. (1971)
Professor of History; A.B., Niagara University, 1960; M.A., Kent State University, 1962; Ph.D., Indiana University, 1967.

McConnell, Michael (1976)
Associate Professor of the Arts; B.F.A., Ohio University, 1970; M.F.A., ibid., 1974.

McCurdy, Russell J. Jr. (1977)
Head Ice Hockey Coach and Lecturer in Physical Education; B.S., Boston University, 1962.

McKeough, D. Michael (1977)
Assistant Professor of Physical Education; B.S., University of New Mexico, 1971; M.S., ibid., 1972; M.Ed., Teachers College, Columbia University, 1975; Ed.D., ibid., 1977.

McNamee, Sheila (1982)
Instructor in Theater and Communication; B.A., University of Massachusetts, 1978; M.A., ibid., 1980.

Mebert, Carolyn J. (1979)
Assistant Professor of Psychology; B.A., Boston University, 1974; Ph.D., ibid., 1978.

Meeker, Loren D. (1970)
Professor of Mathematics; B.A., B.S., Oregon State University, 1959; M.S., Stanford University, 1962; Ph.D., ibid., 1965; M.Sc., University of Aston, England, 1969.

Melvin, Donald W. (1957)
Associate Dean of the College of Engineering and Physical Sciences and Associate Professor of Electrical Engineering; B.S., University of New Hampshire, 1955; M.E., Yale University, 1957; Ph.D., Syracuse University, 1971.

Menge, Carleton P. (1948)
Professor of Education; B.S., Springfield College, 1939; M.A., University of Chicago, 1940; Ph.D., ibid., 1948.

Mennel, Robert M. (1969)
Professor of History; B.A., Denison University, 1960; M.A., Ohio State University, 1965; Ph.D., ibid., 1969.

Merenda, Michael J. (1977)
Assistant Professor of Administration; B.S., B.A., Northeastern University, 1970; M.B.A., ibid., 1972; Ph.D., University of Massachusetts, 1978.

Merritt, Richard D. (1948)
Associate Professor of the Arts; Certificate, Rochester Institute of Technology, 1948.

Merton, Andrew H. (1972)
Associate Professor of English; B.A., University of New Hampshire, 1967.

Messier, Victor R. (1970)
Associate Professor of Home Economics; B.P.E., University of Alberta, 1962; M.S., ibid., 1965; Ph.D., Pennsylvania State University, 1973.

Meyrowitz, Joshua (1979)
Associate Professor of Theater and Communication; B.A., Queens College, 1972; M.A., ibid., 1974; Ph.D., New York University, 1978.

Michael, Joseph (1960)
Lecturer in Business Law; A.B., Dartmouth College, 1945; J.D., Boston University School of Law, 1950.

†Miller, Donald R. (1977)
Assistant Professor of Wildlife Ecology; B.S., Pennsylvania State University, 1955; M.S., ibid., 1957; Ph.D., University of Idaho, 1976.

Miller, Edmund G. (1951)
Professor of English; A.B., Dartmouth College, 1943; M.A., Columbia University, 1947; Ph.D., ibid., 1955.

Miller, Patrick (1979)
Lecturer in Hotel Administration; A.S., Alfred State Technological Institute, 1963; B.S., Michigan State University, 1966.

Miller, W. Thomas, III (1979)
Assistant Professor of Electrical Engineering; B.S., Pennsylvania State University, 1972; M.S., ibid., 1974; Ph.D., ibid., 1977.

Mills, B. Joyce (1967)
Assistant Professor of Physical Education; B.S., Georgia State College for Women, 1949; M.S., University of Tennessee, 1958.

Mills, Richard L. (1967)
Associate Professor of Economics and Administration; B.S., Rose Polytechnic Institute, 1962; M.A., Indiana University, 1964; Ph.D., ibid., 1967.

†Minocha, Subhash C. (1974)
Associate Professor of Botany; B.S.C., Punjab University, 1968; M.Sc., ibid., 1969; Ph.D., University of Washington, 1974.

*†Mitchell, James R. (1964)
Associate Professor of Plant Science and Extension Agronomist, Forage Crops; B.S., University of New Hampshire, 1957; M.S., Pennsylvania State University, 1960; Ph.D., ibid., 1969.

Mitchell, Robert B. (1982)
Faculty in Residence in Administration; B.S., Bradley University, 1967; M.S., ibid., 1969; M.B.A., University of New Hampshire, 1980.

Mooradian, Andrew T. (1950)
Director of the Department of Men's Intercollegiate Athletics and Associate Professor of Physical Education; B.S., University of New Hampshire, 1948; M.S., Boston University, 1958.

Moore, Asher (1961)
Donald C. Babcock Professor of Philosophy; A.B., Wesleyan University, 1940; M.A., Harvard University, 1942; Ph.D., ibid., 1948.

Moore, Berrien, III (1969)
Associate Professor of Mathematics; B.S., University of North Carolina, 1963; Ph.D., University of Virginia, 1969.

Moore, David W. (1972)
Associate Professor of Political Science; B.S., U.S. Military Academy, 1962; M.A., Ohio State University, 1969; Ph.D., ibid., 1970.

Moore, Joseph J. (1975)
Animal Pathologist and Lecturer in Animal Science; B.S., Trinity College, 1966; V.M.D., University of Pennsylvania, 1970.

Morgan, Ann L. (1981)
Assistant Professor of Recreation and Parks; B.A., Hanover College, 1974; M.S., Pennsylvania State University, 1976; Re.D., Indiana University, 1981.

Mori, Haruhide P. (1982)
Visiting Professor in Japanese; B.A., Kobe University, 1956; M.A., Osaka University, 1960; D.Litt., ibid., 1978.

Morin, Robert R. (1965)
Assistant Professor and Catalog Librarian; B.A., University of New Hampshire, 1963; M.S., Simmons College, 1965.

Morin, Stephen J. (1981)
(Captain, U.S. Army) Assistant Professor of Military Science; B.S., University of Maine, 1970; M.B.A., University of Maine, 1972.

Morrison, James D. (1965)
Professor of Chemistry; B.S., Franklin and Marshall College, 1958; Ph.D., Northwestern University, 1963.

Mosberg, William (1958)
Associate Professor of Mechanical Engineering; B.S.M.E., Columbia University, 1956; M.Eng., Yale University, 1960.

Mott, Basil J. F. (1973)
Dean of the School of Health Studies and Professor of Health Administration and Planning; A.B., Amherst College, 1949; M.P.A., John F. Kennedy School of Government, Harvard University, 1953; Ph.D., Harvard University, 1967.

Mower, Lyman (1957)
Professor of Physics; B.S., University of California at Berkeley, 1949; Ph.D., Massachusetts Institute of Technology, 1953.

Moynihan, Robert G. (1978)
Thompson School Assistant Professor of Civil Technology; B.S.C.E., University of New Hampshire, 1968; M.B.A., University of Akron, 1973.

Mulhern, John E., Jr. (1954)
Professor of Physics; B.S., Oklahoma Agricultural and Mechanical College, 1948; M.A., Boston University, 1949; Ph.D., ibid., 1954.

Murdoch, Joseph B. (1952)
Professor of Electrical Engineering; B.S., Case Institute of Technology, 1950; M.S., University of New Hampshire, 1955; Ph.D., Case Institute of Technology, 1962.

Murray, Donald M. (1963)
Professor of English; B.A., University of New Hampshire, 1948.

Murray, Frederick P. (1966)
Associate Professor of Communication Disorders; B.A., Stanford University, 1948; M.A., University of Southern California, 1950; Ph.D., University of Denver, 1966.

Nahin, Paul J. (1975)
Associate Professor of Electrical Engineering; B.S.E.E., Stanford University, 1962; M.S.E.E., California Institute of Technology, 1963; Ph.D., University of California at Irvine, 1972.

Nevin, John A. (1972)
Professor of Psychology; B.E., Yale University, 1954; M.A., Columbia University, 1961; Ph.D., ibid., 1963.

Newkirk, Thomas R. (1977)
Assistant Professor of English; B.A., Oberlin College, 1970; M.Ed., Boston State College, 1973; Ph.D., University of Texas, 1977.

Nicoll, Donald E. (1978)
Adjunct Associate Professor of Health Administration and Planning; B.A., Colby College, 1949; M.A., Pennsylvania State University, 1952.

Nicoloff, Philip L. (1954)
Professor of English; B.A., University of California at Los Angeles, 1949; M.A., Columbia University, 1952; Ph.D., ibid., 1959.

Nielson, Melville (1950)
Associate Dean of the College of Liberal Arts and Associate Professor of Sociology; B.S., Bowling Green State University, 1942; M.A., Ohio State University, 1947; Ph.D., ibid., 1955.

Nordgren, Eric A. (1964)
Professor of Mathematics; B.Ch.E., Polytechnic Institute of Brooklyn, 1956; Ph.D., University of Michigan, 1964.

Noyes, Doris E. (1981)
Assistant Professor of Nursing; B.S.N., University of Massachusetts, 1970; M.S.N., Boston University, 1978.

O'Connell, Lawrence W. (1966)
Associate Professor of Political Science; B.A., University of New Hampshire, 1956; Ph.D., Syracuse University, 1968.

Odell, Ralph, Jr. (1976)
Thompson School Associate Professor of Applied Animal Science; B.S., University of New Hampshire, 1971; M.S., Cornell University, 1973.

Oja, Sharon N. (1977)
Associate Professor of Education; B.A., Macalester College, 1966; M.A., University of Minnesota, 1971; Ph.D., ibid., 1978.

†Olson, David P. (1968)
Professor of Wildlife Management; B.S., University of Minnesota, 1954; M.S., University of Maine, 1958; Ph.D., University of Minnesota, 1964.

Orovich, Nicholas M. (1980)
Faculty in Residence in Music; B.M., University of Wisconsin, 1976; M.M., New England Conservatory of Music, 1978.

Ossenbruggen, Paul J. (1975)
Associate Professor of Civil Engineering; B.C.E., Syracuse University, 1963; M.S., University of Connecticut, 1967; Ph.D., Carnegie-Mellon University, 1970.

O'Sullivan, Michael J. (1977)
Assistant Professor of Health Administration and Planning; B.A., Northeastern University, 1963; M.P.H., University of California at Berkeley, 1969; Dr.P.H., ibid., 1975.

Owens, Charles W. (1963)
Professor of Chemistry; B.S., Colorado College, 1957; Ph.D., University of Kansas, 1963.

Palmer, Stuart H. (1955)
Dean of the College of Liberal Arts and Professor of Sociology; B.A., Yale College, 1949; M.A., Yale University, 1951; Ph.D., ibid., 1955.

†Parker, Richard G. (1982)
Assistant Professor of Forest Resources; B.S., University of Massachusetts, 1956; M.S., ibid., 1966; M.S., University of Southern California, 1971; M.S., University of Arkansas, 1973; Ph.D., University of Michigan, 1982.

†Parsons, Alan H. (1979)
Assistant Professor of Animal Science; B.S., University of Maine, 1973; M.S., Ohio State University, 1976; Ph.D., Cornell University, 1979.

Parssinen, T. Antero (1977)
Assistant Professor of Mechanical Engineering Technology; B.S.M.E., University of New Hampshire, 1960.

Patterson, Peter H. (1980)
Director of Health Services, Adjunct Associate Professor of Health Administration and Planning; A.B., Dartmouth College, 1953; M.D., Tufts University School of Medicine, 1957.

†Peirce, Lincoln C. (1964)
Professor of Plant Science; B.S., Cornell University, 1952; Ph.D., University of Minnesota, 1958.

Penniman, David S. (1980)
(Colonel, U.S. Air Force) Professor of Aerospace Studies; B.S., University of New Hampshire, 1958; M.S., George Washington University, 1969.

†Peterson, Nobel K. (1957)
Associate Professor of Soil and Water Science; B.S., Kansas State College, 1948; M.S., Purdue University, 1950; Ph.D., Rutgers University, 1957.

Petillo, Juliette D. (1973)
Associate Professor of Nursing; B.S.N., St. Anselm College School of Nursing, 1961; M.S., Boston University, 1973.

Petty, Guy E. (1978)
Thompson School Assistant Professor of Civil Technology; B.Arch., Pennsylvania State University, 1969.

Pfanner, Helmut F. (1969)
Professor of German; Teaching Credential, Teachers Training College, Austria, 1952; M.A., Stanford University, 1961; Ph.D., ibid., 1965.

Pierce, Robert S. (1967)
Adjunct Associate Professor of Forestry and Soil and Water Science; B.S., University of Michigan, 1949; M.S., University of Wisconsin, 1952; Ph.D., ibid., 1957.

Pilar, Frank L. (1957)
Professor of Chemistry; B.S., University of Nebraska, 1951; M.S., ibid., 1953; Ph.D., University of Cincinnati, 1957.

Pilgrim, Sidney A. L. (1979)
Adjunct Associate Professor of Soil Science; B.S., University of New Hampshire, 1955.

Pistole, Thomas G. (1971)
Associate Professor of Microbiology; Ph.B., Wayne State University, 1964; M.S., ibid., 1966; Ph.D., University of Utah, 1969.

Pokoski, John L. (1967)
Professor of Electrical Engineering; B.S., St. Louis University, 1959; M.S., Arizona State University, 1965; Ph.D., Montana State University, 1967.

Polasky, Janet L. (1981)
Assistant Professor of History; B.A., Carleton College, 1973; M.A., Stanford University, 1974; Ph.D., ibid., 1978.

Polk, Keith (1964)
Professor of Music; B.A., San Diego State College, 1956; M.M., University of Wisconsin, 1958; Ph.D., University of California at Berkeley, 1968.

Poll, Solomon (1964)
Professor of Sociology; B.S., Temple University, 1955; M.A., University of Pennsylvania, 1957; Ph.D., ibid., 1960.

†Pollard, James E. (1970)
Associate Professor of Plant Science; A.B., Duke University, 1965; Ph.D., University of Florida, 1969.

Porta, Neil Ross (1974)
Associate Professor of Hotel Administration; A.S., Dean Junior College, 1968; B.S., Babson College, 1970; M.B.A., Michigan State University, 1972.

Potter, Hugh M., III (1962)
Associate Professor of English; A.B., Union College, 1954; M.A., University of North Carolina, 1957; Ph.D., University of Minnesota, 1965.

Powell, Lou G. (1981)
Assistant Professor of Recreation and Parks; B.S., Winthrop College, 1972; M.S., Florida State University, 1975; Re.D., Indiana University, 1981.

Power, Marilyn (1979)
Assistant Professor of Economics; B.A., University of California, 1969; Ph.D., ibid., 1977.

Pritchard, Hugh C. (1954)
Professor and Reference Librarian; B.A., University of Washington, 1939; M.A., University of North Carolina, 1942; M.S., Columbia University, 1950.

Puth, Robert C. (1967)
Associate Professor of Economics; B.A., Carleton College, 1958; M.A., Northwestern University, 1965; Ph.D., ibid., 1967.

Quigley, Donald W. (1978)
Thompson School Assistant in Forest Technology; B.S., University of New Hampshire, 1976; M.S., ibid., 1978.

Radlow, James (1965)
Professor of Applied Mathematics; B.A., City College, New York, 1943; Sc.M., Brown University, 1946; Ph.D., New York University, 1957.

Rasico, Philip D. (1982)
Assistant Professor of Spanish; A.B., Xavier University, 1974; M.A., Indiana University, 1975; Ph.D., ibid., 1981.

Rasmussen, Mary H. (1968)
Associate Professor of Music; B.A., University of New Hampshire, 1952; M.M., University of Illinois, 1953; M.L.S., ibid., 1956.

Records, Mary A. (1982)
Assistant Professor of Communication Disorders; B.S., Ohio University, 1973; M.A., Western Michigan University, 1974; Ph.D., University of Minnesota, 1982.

Reed, Robert C. (1960)
Associate Professor and Acquisitions Librarian; B.A., Hartwick College, 1953; A.M.L.S., University of Michigan, 1960.

†Reeves, R. Marcel (1964)
Associate Professor of Entomology and Forest Resources; B.S., State University of New York College of Forestry at Syracuse, 1957; M.S., Cornell University, 1961; Ph.D., State University of New York, College of Forestry at Syracuse, 1964.

Reyna, Stephen P. (1973)
Associate Professor of Anthropology; A.B., Columbia College, 1965; Ph.D., Columbia University, 1972.

Reynolds, Mary K. (1981)
Adjunct Assistant Professor of Forest Resources; B.S., Southern Connecticut State College, 1970; M.F.S., Yale University, 1973.

Richardson, John C. (1946)
Professor of English; A.B., Dartmouth College, 1941; M.A., Columbia University, 1942; Ph.D., Boston University, 1959.

Roberts, Betty Holroyd (1974)
Associate Professor of Social Service; B.A., West Virginia University, 1953; M.S.W., ibid., 1970; Ph.D., Brandeis University, 1975.

Roberts, Bobby E. (1982)
(Major, U.S. Air Force) Assistant Professor of Aerospace Studies; B.S., East Carolina University, 1968; M.S., University of North Dakota, 1975.

***†Roberts, John M.** (1979)
Assistant Professor of Plant Science and Extension Specialist, Turf; B.S., Washington State University, 1974; M.S., Purdue University, 1975; Ph.D., ibid., 1977.

Roberts, June (1982)
Assistant Professor of Nursing; Diploma, Medical College of South Carolina Roper Hospital, 1952; B.S., Boston University, 1963; M.S., Boston College, 1982.

Roberts, Lewis, Jr. (1972)
Director of the Thompson School of Applied Science, Thompson School Associate Professor of Applied Science and Associate Professor of Occupational Education; B.A., Brown University, 1959; M.Ed., Auburn University, 1970; Ed.D., ibid., 1972.

Robertson, Charles L. (1978)
Assistant Professor of Theater and Communication; A.A., Palomar Junior College, 1967; B.F.A., U.S. International University School of Performing Arts, 1969; M.F.A., ibid., 1971.

Robinson, Marsha B. (1982)
Lecturer in Spanish; B.S., Plymouth State College, 1973; M.A., University of New Hampshire, 1982.

Rogers, John E. (1967)
Associate Professor of Music; B.A., B.M., University of Georgia, 1960; M.M., Yale University, 1962; M.F.A., Princeton University, 1966.

*†Rogers, Owen M. (1959)
Professor of Plant Science; B.V.A., University of Massachusetts, 1952; M.S., Cornell University, 1954; Ph.D., Pennsylvania State University, 1959.

Rohrabacher, Evelyn H. (1971)
Thompson School Associate Professor of Communications; B.A., St. Joseph's College, 1941; M.A., University of South Florida, 1968.

Romoser, George K. (1961-62, 1967)
Professor of Political Science; A.B., Rutgers University, 1951; A.M., University of Chicago, 1954; Ph.D., ibid., 1958.

Rosen, Sam (1957)
Nashua Corporation Professor of Economics; B.A., University of Wisconsin, 1942; M.A., Harvard University, 1948; Ph.D., ibid., 1952.

Rosenman, Robert E. (1982)
Assistant Professor of Economics; B.A., University of Pennsylvania, 1975; M.A., ibid., 1977; Ph.D., University of Minnesota, 1982.

Ross, Shepley L. (1955)
Professor of Mathematics; A.B., Boston University, 1949; A.M., ibid., 1950; Ph.D., ibid., 1953.

Rothwell, Kenneth J. (1963)
Professor of Economics; B.A., University of Western Australia, 1949; M.A., ibid., 1954; Ph.D., Harvard University, 1960.

Rouman, John C. (1965)
Associate Professor of Classics; B.A., Carleton College, 1950; M.A., Columbia University, 1951; Ph.D., University of Wisconsin, 1965.

†Routley, Douglas G. (1957)
Professor of Plant Science; B.S.A., University of British Columbia, 1952; M.S., Pennsylvania State University, 1953; Ph.D., ibid., 1957.

Rowe, Carol E. (1977)
Head Swim Coach and Lecturer in Physical Education; B.S., University of Maryland, 1975.

Rudd, Joel (1980)
Assistant Professor of Home Economics; B.A., University of Montana, 1974; M.A., University of Iowa, 1976; Ph.D., ibid., 1979.

Rudd, Mary Jo (1981)
Instructor and Cataloger; B.A., University of Iowa, 1975; M.A., ibid., 1977.

Rupp, Nancy C. (1970)
Assistant Professor of Physical Education; B.S., Sargent College, Boston University, 1950; M.A., State University of Iowa, 1955.

Russell, Maria A. (1982)
Lecturer in Spanish, B.A., University of New Hampshire, 1980; M.A.T., ibid., 1982.

Russell, Robert D. (1975)
Associate Professor of Computer Science; B.A., Yale University, 1965; M.S., Stanford University, 1967; Ph.D., ibid., 1972.

Russell, Sylvia W. (1982)
Adjunct Assistant Professor of Computer Science; B.A., Middlebury College, 1962; M.S., Stanford University, 1970; Ph.D., ibid., 1975.

Rutman, Darrett B. (1968)
Professor of History; A.B., University of Illinois, 1950; Ph.D., University of Virginia, 1959.

Ryan, Kerry (1981)
Adjunct Lecturer in Medical Technology; B.S., Montclair State, 1978; M.T., American Society of Clinical Pathologists, 1979.

Safford, Lawrence O. (1981)
Adjunct Associate Professor of Forestry; B.S., University of Maine, 1961; M.S., Yale University, 1962; Ph.D., University of Maine, 1968.

Samuels, Frederick (1966)
Associate Professor of Sociology; B.S., City College of New York, 1950; M.A., University of Hawaii, 1963; Ph.D., University of Massachusetts, 1966.

Sandler, Melvin (1970)
Associate Professor of Hotel Administration; B.S., Georgetown University, 1941; M.A., Northwestern University, 1947; C.P.A.

Sandoval, Anne W. (1982)
Assistant Professor of Psychology; B.A., University of Massachusetts, 1977; Ph.D., Brandeis University, 1982.

Sands, Merwin R. (1982)
Instructor of Finance; B.A., University of Wisconsin at Milwaukee, 1977; M.A., State University of New York at Buffalo, 1979.

Sasner, John J., Jr. (1965)
Professor of Zoology; B.A., University of New Hampshire, 1957; M.S., ibid., 1959; Ph.D., University of California at Los Angeles, 1965.

Savage, Godfrey H. (1965)
Professor of Mechanical Engineering and Director of Engineering Design and Analysis Lab; B.S.E., Princeton University, 1950; M.S., Stanford University, 1951; M.B.A., Harvard University, 1954; Engr. M.E., Stanford University, 1963; Ph.D., ibid., 1970.

Sawyer, Albert K. (1949)
Professor of Chemistry; A.B., Colby College, 1940; M.S., University of Maine, 1947.

Scharff, Robert C. (1970)
Associate Professor of Philosophy; A.B., University of Illinois, 1961; M.A., Northwestern University, 1965; Ph.D., ibid., 1970.

Schibanoff, Susan (1971)
Associate Professor of English; B.A., Cornell University, 1966; M.A., University of California at Los Angeles, 1967; Ph.D., ibid., 1971.

Schlobohm, Starr F. (1975)
Associate Professor of Administration; B.A., Ohio Wesleyan University, 1950; M.B.A., Harvard Graduate School of Business Administration, 1952; M.Phil., Graduate School of Business Administration, New York University, 1978; Ph.D., ibid., 1980.

Schneer, Cecil J. (1950, 1954)
Professor of Geology and the History of Science; A.B., Harvard University, 1943; A.M., ibid., 1949; Ph.D., Cornell University, 1954.

Schnepf, Scott (1981)
Faculty in Residence in the Arts; B.A., Augustana College, 1977; M.F.A., Kansas State University, 1981.

Schori, Ernst (1979)
Adjunct Lecturer in Medical Technology; B.S., Northeastern University, 1975; Nuclear Medicine Registry.

Schreiber, Richard W. (1957)
Professor of Botany; B.S., University of New Hampshire, 1951; M.S., ibid., 1952; Ph.D., University of Wisconsin, 1955.

†Schwab, Charles (1975)
Associate Professor of Animal Sciences; B.S., University of Wisconsin, 1969; M.S., ibid., 1970; Ph.D., ibid., 1974.

Schwab, Richard L. (1979)
Assistant Professor of Education; B.S., Boston University, 1974; M.A., University of Connecticut, 1978; Ph.D., ibid., 1980.

Schwarz, Marc L. (1967)
Associate Professor of History; A.B., Bates College, 1959; M.A.T., Harvard University, 1960; Ph.D., University of California at Los Angeles, 1965.

Schweickart, Patrocinio P. (1979)
Assistant Professor of English; B.S., University of the Philippines, 1963; M.Ch.E., University of Virginia, 1965; M.A., ibid., 1969; M.A., Ohio State University, 1974; Ph.D., ibid., 1979.

Scott, William H. (1970)
Thompson School Associate Professor of Applied Business Management; B.S., Drexel Institute of Technology, 1961; M.Ed., University of New Hampshire, 1973.

Searls, Maryse P. (1973)
Associate Professor of the Arts; B.F.A., Cleveland Institute of Art, 1971; M.F.A., Alfred University, 1973.

Seavey, John W. (1980)
Assistant Professor of Health Administration and Planning; A.B., Bates College, 1966; M.A., University of Arizona, 1968; Ph.D., ibid., 1973; M.P.H., Harvard University, 1979.

Sebastian, Richard J. (1982)
Faculty in Residence in Administration; B.A., Lewis College, 1970; M.A., University of Wisconsin, 1972; Ph.D., ibid., 1974.

Seidel, Lee F. (1977)
Assistant Professor of Health Administration and Planning; A.B., Hobart College, 1967; M.P.A., Pennsylvania State University, 1972; Ph.D., ibid., 1976.

Seiler, David E. (1972)
Associate Professor of Music; B.M., University of Wisconsin, 1961; M.M., ibid., 1965.

Seitz, W. Rudolf (1976)
Associate Professor of Chemistry; A.B., Princeton University, 1965; Ph.D., Massachusetts Institute of Technology, 1970.

Seybold-Strassler, Beth (1982)
Assistant Professor of Occupational Therapy; B.S., State University of New York at Buffalo, 1976; M.H.S., University of Florida, 1978.

Shapiro, Howard M. (1969)
Associate Professor of Sociology; B.A., Brandeis University, 1964; M.A., Boston University, 1966; Ph.D., University of Minnesota, 1969.

Shar, Albert O. (1971)
Executive Director of Computer Services and Professor of Mathematics; B.A., Brandeis University, 1965; M.A., Fordham University, 1966; Ph.D., University of Pennsylvania, 1970.

Sharkey, Carol (1982)
Instructor in Nursing; B.S.N., Loretto Heights College, 1970; M.S.N., University of Nebraska, 1980.

Shaw, Winifred C. (1954)
Associate Professor of the Arts; B.S., Iowa State College, 1945; M.F.A., Cranbrook Academy of Art, 1953.

Shepard, Harvey K. (1969)
Professor of Physics; B.S., University of Illinois, 1960; M.S., California Institute of Technology, 1962; Ph.D., ibid., 1966.

Sherman, James L. (1967)
Assistant Professor of German; B.A., Wayne State University, 1959; M.A., Middlebury College, 1961; M.A., University of Michigan, 1965; Ph.D., ibid., 1969.

Shigo, Alex L. (1966)
Adjunct Professor of Plant Pathology; B.S., Waynesburg College, 1956; M.S., West Virginia University, 1958; Ph.D., ibid., 1959.

Shippee-Rice, Raelene (1979)
Assistant Professor of Nursing; Diploma, Cook County Hospital, 1960; B.S., Carroll College, 1964; M.S., University of Rochester, 1969.

Shore, Barry (1974)
Professor of Administration; B.S.E.E., Tufts University, 1960; M.B.A., University of Massachusetts, 1963; Ph.D., University of Wisconsin, 1968.

Shore, Samuel D. (1965)
Associate Professor of Mathematics; B.S., Juniata College, 1959; M.A., Pennsylvania State University, 1961; Ph.D., ibid., 1964.

Shortle, Walter C. (1976)
Adjunct Assistant Professor of Botany; B.S., University of New Hampshire, 1968; M.S., ibid., 1970; Ph.D., North Carolina State University, 1974.

Siddall, David V. (1965)
Assistant Professor of English; A.B., Dartmouth College, 1953; M.A., Columbia University, 1960; Ph.D., Indiana University, 1970.

Sillanpoa, Wallace P. (1980)
Faculty in Residence in Italian; A.B., College of the Holy Cross, 1969; Ph.D., University of Connecticut, 1980.

Silva, J. Donald (1963)
Thompson School Associate Professor of Communications; B.A., University of New Hampshire, 1957; M.A., ibid., 1965.

Silverman, Robert J. (1962)
Professor of Mathematics; B.S., University of Chicago, 1947; M.S., ibid., 1948; Ph.D., University of Illinois, 1952.

Silvestro, Richard R. (1981)
Faculty in Residence in Theater and Communication; B.S., State University of New York at Brockport, 1972; M.F.A., Yale School of Drama, 1976.

Simic, Charles D. (1973)
Professor of English; B.A., New York University, 1967.

Simos, Evangelos O. (1977)
Assistant Professor of Economics; B.S., Athens Graduate School of Business and Economics, 1972; M.A., Northern Illinois University, 1974; Ph.D., ibid., 1977.

Simpson, Robert E. (1963)
Associate Professor of Physics; B.S., University of Rochester, 1955; A.M., Harvard University, 1956; Ph.D., ibid., 1960.

Sims, Wilburn L. (1967)
Associate Professor of Theater and Communication; A.B., Dartmouth College, 1964; M.S.T., University of New Hampshire, 1969.

Sir, W. Niel (1970)
Associate Professor of Music; B.A., University of Chicago, 1952; B.A., University of California, 1954; M.A., ibid., 1962.

Sitkoff, Harvard (1976)
Associate Professor of History; A.B., Queens College, 1961; M.A., Columbia University, 1962; Ph.D., ibid., 1975.

Sivaprasad, Kondagunta (1969)
Associate Professor of Electrical Engineering; B.E., University of Madras, 1956; M.S., Harvard University, 1958; Ph.D., ibid., 1963.

*Sloan, Roger P. (1963)
Assistant Professor of Forest Resources and Extension Specialist, Forestry; B.S., University of New Hampshire, 1942; M.P.A., Harvard University, 1960.

Smith, C. Tattersall (1982)
Assistant Professor of Forest Resources; B.A., University of Virginia, 1972; M.S., University of Vermont, 1982.

Smith, David R. (1979)
Assistant Professor of the Arts; A.B. Washington University, 1968; M.A., Columbia University, 1971; M.Phil., ibid., 1978; Ph.D., ibid., 1978.

Smith, Elizabeth C. (1966)
Lecturer in Animal Science; B.S., St. Lawrence University, 1961; M.S., Pennsylvania State University, 1954; Ph.D., ibid., 1958.

Smith, James A. (1972)
Associate Dean of the College of Liberal Arts and Adjunct Associate Professor of Economics; B.A., Washington State University, 1957; Ph.D., ibid., 1967.

Smith, M. Daniel (1967)
Associate Professor of Education; A.B., Dartmouth College, 1948; M.M., University of Michigan, 1950; M.Ed., Harvard University, 1958; Ed.D., ibid., 1961.

Smith, Mark R. (1966)
Professor of English; B.A., Northwestern University, 1960.

Smith, Robin S. (1981)
Assistant Professor and Cataloger; B.A., Washington University, 1968; M.S., Columbia University, 1970.

†Smith, Samuel C. (1961)
Professor of Animal Science and Biochemistry; B.S., Pennsylvania State University, 1955; M.S., ibid., 1958; Ph.D., ibid., 1962.

Snell, Elizabeth A. (1971)
Associate Professor of Home Economics; B.S., University of Vermont, 1949; M.S., Cornell University, 1960; Ph.D., ibid., 1971.

Someshwar, Arun V. (1982)
Assistant Professor of Chemical Engineering; B.S., Indian Institute of Technology, 1976; M.S., Michigan State University, 1979; Ph.D., ibid., 1982.

Soukaris, Pauline (1959)
Associate Professor of Social Service; B.S., University of New Hampshire, 1950; M.S., Boston University School of Social Work, 1959.

Sower, Stacia A. (1982)
Assistant Professor of Zoology; B.A., University of Utah, 1973; M.S., Oregon State University, 1978; Ph.D., ibid., 1980.

Spears, Margaret W. (1981)
Assistant Professor of Nursing; B.S.N., University of Pittsburgh, 1952; M.S., University of Lowell, 1979.

Sprague, Linda G. (1969)
Professor of Administration; S.B., Massachusetts Institute of Technology, 1961; M.B.A., Boston University, 1967; D.B.A., Harvard University, 1973.

Sproul, Otis J. (1982)
Dean of the College of Engineering and Physical Sciences and Professor of Civil Engineering; B.S., University of Maine, 1952; M.S. ibid., 1957; Sc.D., Washington University, 1961.

Steese, Peter G. (1980)
Faculty in Residence in German; B.A., University of Maryland at College Park, 1974; M.A., ibid., 1976.

†Stewart, James A. (1968)
Professor of Biochemistry; B.A., St. Anselm's College, 1963; Ph.D., University of Connecticut, 1967.

Stibler, Robert (1978)
Assistant Professor of Music; B.S., Susquehanna University, 1970; M.M., The Catholic University of America, 1973; D.M.A., ibid., 1979.

Stone, Deborah E. (1962)
Associate Professor of Education; B.Ed., Plymouth Teachers College, 1940; M.Ed., Boston University, 1951; Ed.D., ibid., 1971.

Straus, Murray A. (1968)
Professor of Sociology; B.A., University of Wisconsin, 1948; M.S., ibid., 1949; Ph.D., ibid., 1956.

†Strout, Richard G. (1954)
Professor of Animal Science; B.S., University of Maine, 1950; M.S., University of New Hampshire, 1954; Ph.D., ibid., 1961.

Sundberg, Donald C. (1978)
Associate Professor of Chemical Engineering; B.S., Worcester Polytechnic Institute, 1965; M.S., University of Delaware, 1968; Ph.D., ibid., 1970.

Sung, Windsor (1980)
Assistant Professor of Civil Engineering; B.S., Massachusetts Institute of Technology, 1975; M.S., California Institute of Technology, 1976; Ph.D., ibid., 1981.

Sussenberger, Barbara (1978)
Associate Professor of Occupational Therapy; B.S., Tufts University, 1961; M.S., Boston University, 1975.

Sweet, Denis M. (1979)
Assistant Professor of German; A.B., Stanford University, 1965; M.A., ibid., 1970; Ph.D., ibid., 1978.

Swift, M. Robinson (1976)
Associate Professor of Mechanical Engineering; B.S., University of New Hampshire, 1971; Ph.D., ibid., 1974.

Taft, Charles K. (1967)
Professor of Mechanical Engineering; B.A., Amherst College, 1951; B.S., Massachusetts Institute of Technology, 1953; M.S., Case Institute of Technology, 1956; Ph.D., ibid., 1960.

†Tagliaferro, Anthony R. (1978)
Assistant Professor of Animal Science and Nutrition; B.S., Boston College, 1968; M.S., Lehigh University, 1972; Ph.D., Cornell University, 1978.

Taylor, James T. (1977)
Assistant Professor of Zoology; B.S., University of Tennessee, 1966; M.S., ibid., 1968; Ph.D., Oregon State University, 1976.

Tebbetts, Diane R. (1978)
Associate Professor and Assistant University Librarian; B.A., University of New Hampshire, 1965; M.S., Simmons College, 1972; M.L.A., Boston University, 1978.

Thewke, Siegfried E. (1979)
Adjunct Assistant Professor of Entomology and State Entomologist, New Hampshire Department of Agriculture; B.S., University of Georgia, 1964; M.S., University of Missouri, 1967; Ph.D., ibid., 1977.

Thompson, Allen R. (1974)
Associate Professor of Economics; B.A., Austin College, 1966; Ph.D., University of Texas at Austin, 1973.

†Thompson, Henry J. (1979)
Associate Professor of Animal Science and Nutrition; B.S., Rutgers University, 1972; M.S., ibid., 1974; Ph.D., ibid., 1975.

Tillinghast, Edward K. (1967)
Associate Professor of Zoology; B.S., University of Rhode Island, 1955; M.S., ibid., 1959; Ph.D., Duke University, 1966.

Tillotson-Adams, Tamara E. (1980)
Faculty in Residence in Education; B.A., Mt. Holyoke College, 1960; M.Sp.Ed., Bridgewater State College, 1973.

Tischler, Herbert (1965)
Professor of Geology; B.S., Wayne State University, 1950; M.A., University of California at Berkeley, 1955; Ph.D., University of Michigan, 1961.

Tokay, F. Harry (1973)
Associate Professor of Communication Disorders; B.S., St. Cloud State College, 1960; M.A., Michigan State University, 1962; Ph.D., ibid., 1967.

Tomasi, Joan J. (1982)
Assistant Professor of Nursing; B.S., University of Vermont, 1962, M.A., Dartmouth college, 1976; M.Ed., Columbia University, Teachers College, 1982.

Tovey, Barbara S. (1978)
Assistant Professor of Philosophy; B.A., Swarthmore College, 1945; Ph.D., University of Massachusetts, 1975.

Trachte, Sharon R. (1981)
Faculty in Residence in French; B.A., Muskingum College; M.A., University of Kentucky, 1975.

Triplett, Timm A. (1981)
Instructor in Philosophy; B.A., Antioch College, 1972; M.A., University of Massachusetts at Amherst, 1979; Ph.D., ibid., 1982.

Trout, B. Thomas (1969)
Associate Professor of Political Science; B.A., University of California at Los Angeles, 1961; M.A., Indiana University, 1968; Ph.D., ibid., 1972.

Tucker, Charles F. (1979)
Adjunct Associate Professor of Law; B.A., Yale University, 1963; J.D., ibid., 1966.

Tuttle, Steven D. (1981)
Thompson School Instructor in Applied Business Management; A.A.S., Thompson School of Applied Science, 1976; B.S., University of New Hampshire, 1979.

Ulrich, Gael D. (1970)
Professor of Chemical Engineering; B.S., University of Utah, 1959; M.S., ibid., 1962; Sc.D., Massachusetts Institute of Technology, 1964.

Ulrich, Laurel T. (1980)
Assistant Professor of Humanities; B.A., University of Utah, 1960; M.A., Simmons College, 1971; Ph.D., University of New Hampshire, 1980.

†Urban, Willard E., Jr. (1963)
Associate Director of the Agricultural Experiment Station and Associate Professor of Biometrics; B.S., Virginia Polytechnic Institute, 1958; M.S., Iowa State University, 1960; Ph.D., ibid., 1963.

Urquhart, James H. (1979)
Head Wrestling Coach, Assistant Lacrosse Coach and Lecturer in Physical Education; A.A.S., State University of New York at Farmingdale, 1972; B.S., University of Rhode Island, 1974; M.S., ibid., 1978.

Ury, Ann D. (1973)
Associate Professor of Occupational Therapy; B.S., University of New Hampshire, 1956; M.A., Brown University, 1968; C.A.G.S., Rhode Island College, 1973.

Vagts, Peggy A. (1978)
Assistant Professor of Music; B.M., Morningside College, 1978; M.M., University of Wisconsin at Madison, 1978.

Valentine, Russell L. (1953)
Professor of Mechanical Engineering; Certificate in Machine Design, Wentworth Institute, 1942; B.S., Michigan State University, 1951; M.S.M.E., Purdue University, 1954.

Valenza, Daniel L. (1959)
Associate Professor of the Arts; A.A.S., School for American Craftsmen at Rochester Institute of Technology, 1956; B.F.A., ibid., 1958; M.F.A., ibid., 1966.

Van Osdol, Donovan H. (1970)
Professor of Mathematics; A.B., Earlham College, 1964; A.M., University of Illinois, 1966; Ph.D., ibid., 1969.

Vaughn, Sharon R. (1982)
Assistant Professor of Education; B.S., University of Missouri, 1973; M.Ed., University of Arizona, 1976; Ph.D., ibid., 1981.

Veal, Larry J. (1982)
Assistant Professor of Music; B.S., University of Illinois, 1974; M.M. Cello, ibid., 1976.

Verrette, Paul F. (1962)
Associate Professor of Music; B.A., University of New Hampshire, 1952; M.A., Boston University, 1971.

Vincent, Donald E. (1962)
Professor and University Librarian; B.A., State University of New York at Buffalo, 1949; A.M.L.S., University of Michigan. 1952; A.M., ibid., 1957; Ph.D., ibid., 1974.

Voll, John O. (1965)
Professor of History; B.A., Dartmouth College, 1958; M.A., Harvard University, 1960; Ph.D., ibid., 1969.

Vrooman, Jack R. (1971)
Associate Professor of French; A.B., Princeton University, 1951; M.A., Columbia University, 1952; Ph.D., Princeton University, 1965.

Wadoski, Kenneth W. (1982)
Faculty in Residence in Administration; B.A., University of Massachusetts, 1969; M.A., Northeastern University, 1970; Ph.D., Boston College, 1975; M.B.A., ibid., 1981.

Walker, Charles W. (1976)
Associate Professor of Zoology; B.A., Miami University, 1969; M.S., Cornell University, 1973; Ph.D., ibid., 1976.

Walker, Susan V. (1977, 1981)
Lecturer in Nursing; B.S.N., University of Maine, 1973.

Wallace, William H. (1957)
Professor of Geography; B.S., Beloit College, 1948; M.S., University of Wisconsin, 1950; Ph.D., ibid., 1956.

Wang, Rosemary Y. (1971)
Associate Professor of Nursing; Diploma, Good Samaritan School of Nursing, Cincinnati, 1957; B.S., College of Mt. St. Joseph, 1959; M.S., Boston College, 1962; Ph.D., ibid., 1982.

Wang, Tung-Ming (1961)
Professor of Civil Engineering; B.S., National Chiao-Tung University, 1945; M.S., University of Missouri, 1954; Ph.D., Northwestern University, 1960.

Ward, Elizabeth, A. (1972)
Adjunct Clinical Instructor in Medical Technology; B.S., University of New Hampshire, 1947; M.T., American Society of Clinical Pathologists, 1947.

Ward, Judith D. (1972)
Associate Professor of Occupational Therapy; B.S., University of New Hampshire, 1964; M.O.E., ibid., 1976.

Ward, Sally (1980)
Assistant Professor of Sociology; B.A., University of Maryland, 1970; M.A., Brown University, 1974; Ph.D., ibid., 1977.

Warner, Rebecca M. (1981)
Assistant Professor of Psychology; B.A., Carnegie-Mellon University, 1973; Ph.D., Harvard University, 1978.

Warren, Jerry A. (1971)
Director of the Office of Biometrics and Associate Professor of Plant Science; B.S., University of Wisconsin, 1953; M.S., Cornell University, 1958; Ph.D., ibid., 1960.

Waterfield, D. Allan (1970)
Associate Professor of Physical Education; B.A., Ohio Wesleyan University, 1962; M.S., Springfield College, 1965; Ph.D., Ohio State University, 1976.

Waters, Harry J. (1982)
Visiting Professor of Marketing; B.B.A., Hofstra College, 1954; M.B.A., New York University, 1955; Ph.D., ibid., 1964.

Watson, Deborah (1967)
Assistant Professor and Assistant Reference Librarian; B.A., University of New Hampshire, 1963; M.A., ibid., 1967; M.S., Simmons College, 1972.

Watson, Winsor H., III (1978)
Assistant Professor of Zoology; B.A., Wesleyan University, 1972; Ph.D., University of Massachusetts, 1978.

Watters, David H. (1978)
Assistant Professor of English; A.B., Dartmouth College, 1972; Ph.D., Brown University, 1978.

Wear, Robert E. (1964)
Associate Professor of Physical Education; B.A., Oberlin College, 1941; M.A., University of Michigan, 1946; Ph.D., ibid., 1955.

Weathersby, Rita (1978)
Assistant Professor of Administration; A.B., University of California at Berkeley, 1965; M.A.T., Harvard University, 1968; C.A.S., ibid., 1974; Ed.D., ibid., 1977.

Webb, Dwight (1967)
Associate Professor of Education; B.A., University of Redlands, 1955; M.A., ibid., 1956; Ph.D., Stanford University, 1967.

Webber, William R. (1969)
Professor of Physics, B.S., Coe College, 1951; M.S., University of Iowa, 1955; Ph.D., ibid., 1957.

Weber, James H. (1963)
Professor of Chemistry; B.S., Marquette University, 1959; Ph.D., Ohio State University, 1963.

Weiland, Walter E. (1964)
Associate Professor of Physical Education; B.S., State University of New York at Cortland, 1957; M.S., Pennsylvania State University, 1958; Ph.D., ibid., 1964.

Weiner, James L. (1979)
Assistant Professor of Computer Science; B.S., University of Massachusetts, 1973; M.S., University of Wisconsin at Madison, 1975; Ph.D., University of California at Los Angeles, 1979.

Weisman, Gary R. (1977)
Assistant Professor of Chemistry; B.S., University of Kentucky, 1971; Ph.D., University of Wisconsin, 1976.

***†Wells, Otho S.** (1966)
Associate Professor of Plant Science and Extension Horticulturist, Vegetables; B.S., North Carolina State University, 1961; M.S., Michigan State University, 1963; Ph.D., Rutgers University, 1966.

†Wells, Roger E. (1981)
Assistant Professor of Animal Science; B.S., Ohio State University, 1968; D.V.M., Ohio State University, 1972.

Wetzel, William E., Jr. (1967)
Professor of Administration; B.A., Wesleyan University, 1950; M.B.A., Temple University, 1965; M.B.A., University of Chicago, 1967.

†Weyrick, Richard R. (1970)
Associate Professor of Forest Resources; B.S., University of Minnesota, 1953; M.F., ibid., 1961; Ph.D., ibid., 1968.

Wheeler, Charles M., Jr. (1950)
Professor of Chemistry; B.S., West Virginia University, 1947; M.S., ibid., 1949; Ph.D., ibid., 1951.

Wheeler, Douglas L. (1965)
Professor of History; A.B., Dartmouth College, 1959; A.M., Boston University, 1960; Ph.D., ibid., 1963.

White, Barbara A. (1976)
Associate Professor and Special Collections Librarian; A.B., Cornell University, 1964; M.A., University of Wisconsin, 1965; Ph.D., ibid., 1974; M.S., Simmons College, 1976.

White, Susan O. (1969)
Associate Professor of Political Science; A.B., Bryn Mawr College, 1958; M.A. University of Minnesota, 1966; Ph.D., ibid., 1970.

Whittier, Duane H. (1967)
Professor of Philosophy; B.A., University of New Hampshire, 1950; M.A., University of Illinois, 1952; Ph.D., ibid., 1961.

Wicks, John D. (1956)
Professor of Music; A.B., Harvard University, 1944; A.M., ibid., 1947; Ph.D., ibid., 1959.

Wilcox, Donald J. (1970)
Professor of History; A.B., Wesleyan University, 1961; A.M., Harvard University, 1962; Ph.D., ibid., 1967.

Williams, Carol L. (1978)
Assistant Professor of Nursing; A.S., Vermont College, 1970; B.S.N., Catholic University of America, 1972; M.S.N., ibid., 1975; D.N.Sc., ibid., 1979.

Williams, Daniel C. (1970)
Associate Professor of Psychology; B.A., Northwestern University, 1966; Ph.D., University of California at Santa Barbara, 1970.

Williams, Thomas A., Jr. (1958)
Professor of English; B.A., University of New Hampshire, 1950; M.A., ibid., 1958.

Willits, Robin D. (1965)
Professor of Administration and Organization; A.B., Middlebury College, 1947; B.S., Massachusetts Institute of Technology, 1948; Ph.D., ibid., 1965.

Wilson, John A. (1960)
Associate Professor of Mechanical Engineering; B.S., Tufts University, 1958; M.S., Northeastern University, 1960; Ph.D., ibid., 1970.

Wing, Barbara H. (1970)
Assistant Professor of Spanish; B.A., Middlebury College, 1955; M.A.T., Harvard University, 1956; M.A., Middlebury College, 1971; Ph.D., Ohio State University, 1980.

Wing, Henry J., Jr. (1970)
Associate Professor of Music; B.M., Oberlin Conservatory, 1952; M.M., ibid., 1953; Ph.D., Boston University, 1966.

Winn, Alden L. (1948)
Professor of Electrical Engineering; B.S., University of New Hampshire, 1937; S.M., Massachusetts Institute of Technology, 1948.

Winslow, Deborah (1978)
Assistant Professor of Anthropology; B.A., Brandeis University, 1968; M.A., Stanford University, 1970; Ph.D., ibid., 1982.

Winslow, Mary Bowes (1978)
Assistant Professor of Education; B.A., University of California at Berkeley, 1945; M.Ed., University of Southern California, 1960; Ed.D., Harvard University, 1974.

Winslow, Ronald A., Jr. (1978)
Assistant Professor of English; B.A., University of New Hampshire, 1971.

Wirth, Cliford J. (1981)
Assistant Professor of Political Science; B.A., Muhlenberg College, 1969; M.P.A., California State University, 1971; Ph.D., Southern Illinois University at Carbondale, 1976.

Witzling, Mara R. (1977)
Assistant Professor of the Arts; B.A., Queens College, 1967; M.A., Cornell University, 1970; Ph.D., ibid., 1978.

Wong, Edward Hou Sen (1978)
Assistant Professor of Chemistry; B.S., University of California at Berkeley, 1968; Ph.D., Harvard University, 1975.

Woodward, William R. (1975)
Associate Professor of Psychology; B.A., Harvard University, 1967; M.A., Princeton University, 1969; Ph.M., Yale University, 1973; Ph.D., ibid., 1975.

Wright, John J. (1970)
Professor of Physics; B.S., Worcester Polytechnic Institute, 1965; Ph.D., University of New Hampshire, 1969.

Wrightsman, Dwayne E. (1964)
Professor of Finance and Administration; B.S., Manchester College, 1958; M.B.A., Indiana University, 1959; Ph.D., Michigan State University, 1964.

Yamamoto, Yutaka (1973)
Associate Professor of Philosophy; B.S., University of California at Berkeley, 1957; M.A., University of Michigan, 1967; Ph.D., ibid., 1973.

Yeager, Jack A. (1981)
Assistant Professor of French; B.A., Colorado State University, 1968; M.A., University of Kentucky, 1969; Ph.D., University of Wisconsin at Madison, 1982.

Yildiz, Asim (1967)
Professor of Mechanics; Dipl., Technical University of Istanbul, 1953; D.Eng., Yale University, 1959.

Yount, John A. (1962-64, 1965)
Professor of English; B.A., Vanderbilt University, 1960; M.F.A., University of Iowa, 1962.

Zabarsky, Melvin J. (1969)
Professor of the Arts; B.F.A., Boston University, 1958; M.F.A., University of Cincinnati, 1960.

Zaso, Gus C. (1970)
Associate Professor of Recreation and Parks; A.B., Syracuse University, 1957; M.A., Central Michigan University, 1962; Re.D., Indiana University, 1965.

Zezula, Jerilee A. (1979)
Thompson School Assistant Professor of Applied Animal Science; B.S., Michigan State University, 1970; D.V.M., ibid., 1971.

Zsigray, Robert M. (1970)
Associate Professor of Microbiology; A.B., Miami University, 1961; M.S., Georgetown University, 1967; Ph.D., ibid., 1969.

Cooperative Extension Staff

Adams, Nancy E., B.S., M.S. (1980)
Extension Instructor and County Extension Agent, Agriculture, Rockingham County.

Auger, Philip A., B.S.F. (1977)
Assistant Extension Educator, Acting County Extension Forester, Rockingham County.

Barker, Floyd V., B.S. (1967)
Associate Extension Educator, Extension Specialist, Environment and Co-Rural Safety Coordinator.

Barney, Sally W., B.S., (1982)
Extension Instructor and County Extension Agent, 4-H, Strafford County.

Bennett, Karen P., B.S.F. (1980)
Extension Instructor and Assistant County Forester, Hillsborough County.

Black, Donald C., B.S. (1971)
Assistant Extension Educator, County Extension Forester and County Coordinator, Strafford County.

Blais, Dana, B.S.F. (1980)
Extension Instructor and County Forester, Coos County.

Bressett, Lauren L., B.S. (1976)
Extension Instructor and County Extension Agent, 4-H, Cheshire County.

Buck, Charles W., B.S., M.S. (1955)
Extension Educator, County Coordinator and County Extension Agent, 4-H, Hillsborough County.

Buob, Thomas E., B.S., M.S. (1982)
Assistant Extension Educator and County Extension Agent, Agriculture, Grafton County.

Burke, Robert E., B.S., M.F. (1981)
Assistant Extension Educator and County Extension Forester, Grafton County.

Bush, Judith, J., B.S., M.A. (1979)
Assistant Extension Educator and County Extension Agent, Home Economics, Merrimack County.

Buteau, Shirley O., B.S. (1979)
Assistant Extension Educator and County Extension Agent, Home Economics.

Buxton, David L., A.A.S., B.S. (1975)
Assistant Extension Educator and Extension Specialist, Logging.

Cavanagh, Joyce Ann, B.S., M.S. (1982)
Assistant Extension Educator and Extension Specialist, Family Resource Management.

Chamberlin, Roxann, B.S., M.E.E. (1978)
Assistant Extension Educator and County Extension Agent, 4-H, Coos County.

Cheever, Deborah J., B.S. (1977)
Extension Instructor and County Extension Agent, 4-H, Merrimack County.

Chesley, Cathy P., B.A., M.S. (1980)
Extension Instructor and County Assistant Extension Agent, 4-H Outdoor Recreation, Hillsborough County.

Clark, Virginia E., B.E. (1963)
Assistant Extension Educator and County Extension Agent, Home Economics, Merrimack County.

Clifford, Virginia W., B.S., M.S. (1978)
Assistant Extension Educator and County Extension Agent, 4-H, Belknap County.

Colby, Perley D., B.S. (1953)
Associate Extension Educator and County Extension Agent, Agriculture, Hillsborough County.

Conde, John A., A.A.S., B.S. (1970)
Assistant Extension Educator and County Extension Forester, Merrimack County.

Corrow, Henry W., Jr., B.S. (1953)
Associate Extension Educator and Extension Editor.

Corso, Carol L., B.S., M.S. (1982)
Assistant Extension Educator and County Extension Agent, Home Economics, Strafford County.

Courser, Carol M., B.S., M.Ed. (1977)
Associate Extension Educator and Extension Specialist, Nutrition.

Cross, Charlotte W., B.S., M.S. (1981)
Assistant Extension Educator and Extension Specialist, Textiles and Clothing, Home Environment.

Cushman, Norman D., A.A.S., B.S. (1981)
Extension Instructor and Assistant County Extension Forester, Merrimack County.

Damon, John F., B.S., M.S. (1961)
Extension Educator and Extension Program Leader, Agriculture.

Danko, Thomas, B.S., M.S. (1957)
Associate Extension Educator and Area Extension Agent, Poultry Management.

Davis, Leona E., R.D.-B.S., B.S. (1982)
Extension Instructor and County Extension Agent. Hillsborough County.

Dodge, Arthur G., Jr., A.A., B.S., M.S.F. (1960)
Extension Educator and Extension Program Leader, Forestry.

Dole, Sumner A., III, B.S. (1977)
Assistant Extension Educator and County Extension Forester, Belknap County.

Dusseault, Laurel A., B.S. (1980)
Assistant Extension Agent and County Extension Agent, 4-H, Hillsborough County.

Eaton, Alan T., B.S., M.S., Ph.D. (1978)
Assistant Extension Educator and Extension Specialist, Pest Management.

Fabrizio, Richard F., B.V.A. (1965)
Assistant Extension Educator and County Extension Agent, 4-H, Grafton County.

Farrey, Judith E., B.S. (1973)
Associate Extension Educator, County Coordinator and County Extension Agent, 4-H, Cheshire County.

Feist, Eleanor H., B.S. (1979)
Assistant Extension Educator and County Extension Agent, Home Economics, Grafton County.

Fell, Jeffrey D., A.A., B.S., M.S. (1980)
Assistant Extension Educator and Extension Specialist, Energy.

Ferguson, John R., Jr., B.S. (1965)
Assistant Extension Educator and County Extension Forester, Hillsborough County.

Garland, Lynn, B., B.S., M.S. (1969)
Associate Extension Educator, County Coordinator and County Extension Agent, 4-H, Rockingham County.

George, Ernest A., B.S. (1955)
Associate Extension Educator and Area Extension Agent, Dairy/Agricultural Business Management: Cheshire, Hillsborough, Rockingham, and Strafford Counties.

Gilman, Francis E., B.S. (1969)
Associate Extension Educator and Extension Specialist, Agricultural Engineering/Co-Rural Safety Coordinator.

Goodson, Marjorie D., B.S.
Extension Instructor, County Coordinator and County Extension Agent, 4-H, Grafton County.

Grady, James E., B.S. (1979)
Assistant Extension Educator, County Extension Agent, 4-H, and County Coordinator, Merrimack County.

Gregory, Paula J., B.Ed., M.D.E. (1980)
Assistant Extension Educator and County Extension Agent, Home Economics, Hillsborough County.

Howe, Gerald W., B.S., M.S. (1972)
Assistant Extension Educator and Extension Specialist, Community and Rural Development.

Hunter, Barbara J., B.A., M.S. (1981)
Assistant Extension Educator and County Extension Agent, Home Economics, Belknap County.

Kaseoru, Peter W., B.A., B.S., M.S. (1981)
Extension Instructor and County Extension Agent, Agriculture, Cheshire County.

Kennedy, Kevin B., B.S.A. (1955)
Associate Extension Educator and Area Extension Agent, Dairy, Grafton and Coos Counties.

Knowles, Stanley W., B.S., M.S. (1962)
Extension Educator and Acting Associate Program Leader, Forestry.

Knox, Harry B., B.S. (1954)
Associate Extension Educator and County Extension Agent, 4-H, Rockingham County.

Lipinski, Tanya K., B.S., M.S. (1982)
Extension Instructor and County Extension Agent, Home Economics, Sullivan County.

Long, Valerie A., B.A. (1979)
Assistant Extension Educator and Extension Specialist, EFNEP.

Lord, William G., B.S., M.S. (1973)
Associate Extension Educator and Extension Specialist, Fruit.

Lovering, Edith L., B.E. (1971)
Assistant Extension Educator and County Extension Agent, Home Economics, Rockingham County.

Maes, Deborah B., B.S. (1982)
Extension Instructor and County Extension Agent, Home Economics, Grafton County.

Marriott, Bruce A., B.S., M.S. (1973)
Associate Extension Educator, Agricultural Agent, and Belknap County Coordinator.

McAllister, Edward H., B.S., M.S. (1981)
Assistant Extension Educator and County Extension Agent, 4-H, Carroll County

McCandlish, Brooks, B.S., M.S. (1981)
Extension Instructor and Assistant County Extension Forester, Hillsborough County.

McGee, Bonnie D., B.S., M.S., M.E. (1972)
Extension Educator and Extension Program Leader, Home Economics.

Mitchell, Frank S., A.A.S., B.S., M.S. (1980)
Assistant Extension Educator and County Extension Agent, 4-H Outdoor Recreation, Hillsborough County.

Parr, Northam D., B.S., M.S. (1982)
Extension Instructor and Assistant County Extension Forester, Grafton County.

Patmos, Ray M., Jr., B.S., M.S. (1972)
Associate Extension Educator, County Extension Forester, Cheshire County.

Pike, John E., B.S., M.P.A. (1977)
Associate Extension Educator and Program Leader, 4-H Youth Development.

Pike, Laura A., B.S. (1982)
Extension Instructor and County Extension Agent, 4-H, Sullivan County.

Pohl, Peter W., B.S., M.S. (1969)
Associate Extension Educator and County Extension Forester, Carroll County.

Pollock, Wendy Legg, B.S., M.Ed. (1982)
Assistant Extension Educator and County Extension Agent, Home Economics, Cheshire County.

Porter, John C., B.S., M.S. (1974)
Associate Extension Educator and Area Extension Agent, Dairy; Belknap, Carroll, Merrimack, and Sullivan Counties.

Pratt, Leighton, C., B.S., M.S. (1969)
Assistant Extension Educator, Acting County Coordinator and County Extension Agent, Agriculture, Coos County.

Roberts, Susan King, B.S. (1980)
Extension Instructor and County Extension Agent, 4-H, Sullivan County.

Schneider, Jill S., B.S., M.S. (1981)
Extension Instructor and Assistant Extension Agent, Agriculture, Hillsborough County.

Schroeder, Calvin E., B.S., M.S. (1969)
Associate Extension Educator and County Extension Agent, Agriculture, Strafford County.

Sciabarrasi, Michael R., B.S., M.S. (1980)
Assistant Extension Educator and Extension Specialist, Agricultural Business Management.

Seavey, David C., A.A.S., B.S., M.S. (1970)
Associate Extension Educator and County Extension Agent, Agriculture, Merrimack County.

Smith, James W., B.S., M.S., Ph.D. (1976)
Associate Extension Educator and Extension Specialist, Dairying.

Sorensen, David C., B.S., M.S. (1969)
Associate Extension Educator, County Extension Agent, Agriculture, and County Coordinator, Carroll County.

Stocking, Marion I., B.S., M.A. (1958)
Associate Extension Educator and County Extension Agent, Home Economics, Carroll County.

Strzok, Beverly J., B.S., M.S. (1980)
Assistant Extension Educator and Extension Specialist, Human Development.

Swier, Stanley R., M.S., Ph.D. (1978)
Associate Extension Educator, Extension Specialist, Entomology/Pesticide Applicator Training.

Szymujko, Joseph A., B.S. (1958)
Assistant Extension Educator and County Extension Forester, Sullivan County.

Tooch, David E., B.S., M.B.A. (1979)
Assistant Extension Educator and Extension Specialist, Sawmill Operations.

Tuttle, Emma Lee, B.S., M.Ed. (1979)
Assistant Extension Educator and County Extension Agent, 4-H, Hillsborough County.

Upham, Edward F., B.S., M.S. (1960)
Extension Educator and County Extension Agent, Agriculture, Rockingham County.

VanLandingham, Carol J., B.A., M.S.W. (1981)
Assistant Extension Educator and County Extension Agent, 4-H, Strafford County.

Weddle, Benjamin H., Jr., B.S., M.S., Ed.D. (1978)
Extension Educator and Assistant Director.

Williams, Charles H., B.S., M.S., Ph.D. (1969)
Associate Extension Educator and Extension Specialist, Ornamentals.

Wood, Dorothy A., B.S. (1971)
Assistant Extension Educator and County Extension Agent, Home Economics, Hillsborough County.

Wood, Stephen, A., B.S. (1974)
Assistant Extension Educator and Assistant County Extension Forester, Sullivan County.

Administrative Divisions

Academic Affairs
Gordon A. Haaland, Vice President

Administrative Services
Phyllis R. Forbes, Director

Admissions
Stanwood C. Fish, Director

Affirmative Action
Nancy H. Deane, Director

Alumni Relations
William J. Rothwell, Director

Athletics and Recreation
Intercollegiate Athletics for Men
Andrew T. Mooradian, Director
Intercollegiate Athletics for Women
Gail A. Bigglestone, Director
Recreation
C. Michael O'Neil, Director

Biometrics
Jerry A. Warren, Director

Bookstore
John R. Maier, Manager

Business Administrator, Interim
L. Brooks Terrio

Career Planning and Placement
Edward J. Doherty, Director

Center for Educational Field Services
Richard H. Goodman, Director

Chaplains
Rabbi Arnold Bienstock, Temple Israel (Jewish)
Mr. Michael Chase, New Creation Fellowship
The Rev. Richard J. Coleman, Community Church (Prot.)
The Rev. Harold C. Criswell, Community Church (Prot.)
Fr. Joseph B. Desmond, St. Thomas More (R.C.)
The Rev. David L. Grainger, Campus Ministry
Fr. Frederick Pennett, St. Thomas More (R.C.)
The Rev. Albert W. Snow, St. Georges (Epis.)
The Rev. Roy Swanson, Evangelical Church
Ms. Jeanne Wetherby, St. Thomas More (R.C.)

Computer Services
Albert O. Shar, Executive Director

Continuing Education, Division of
Edward J. Durnall, Director

Cooperative Extension Service
Maynard C. Heckel, Director

Counseling and Testing Center
Thomas E. Dubois, Director

Dean of Students Office
J. Gregg Sanborn, Dean

Development Office
Robert W. Leberman, Director

Engineering Design and Analysis Laboratory
Godfrey H. Savage, Director

Engineering & Physical Sciences, College of
Otis J. Sproul, Dean

Facilities Services
Patrick J. Miller, Interim Director

Financial Affairs and Administration
Frank J. Bachich, Vice President

Financial Aid
Richard H. Craig, Director

Financial Services
J. Jerrold Jackson, Director

Graduate School
Raymond L. Erickson, Dean

Health Services
Peter H. Patterson, Director

Health Studies, School of
Basil J. F. Mott, Dean

Institutional Research
John D. Kraus, Jr., Director

Jackson Estuarine Laboratory
Arthur C. Mathieson, Director

Liberal Arts, College of
Stuart H. Palmer, Dean

Library
Donald E. Vincent, Librarian

Life Sciences and Agriculture, College of
Kurt C. Feltner, Dean

Marine Program
Robert W. Corell, Director

Media Services
John D. Bardwell, Director

New England Center for Continuing Education
Anthony S. Codding, Director

News Bureau
Phyllis W. Bennett, Director

Personnel Services
Frederic E. Arnold, Director

President's Office
Evelyn E. Handler, President

Public Administration Service
Lawrence W. O'Connell, Director

Public Television (Channel 11)
Arthur J. Singer, General Manager

Public Safety
David A. Flanders, Director

Radiation Safety Office
William Dotchin, Radiation Safety Officer

Registration and Records
Stephanie M. Thomas, Registrar

Research Administration
Lennard A. Fisk, Jr., Director

Reserve Officers Training Corps
Col. David F. Penniman, Prof. of Aerospace Studies
Lt. Col. Michael H. Everngam, Prof. Military Science

Residential Life
Carol J. Bischoff, Director

Space Science Center
Joseph V. Hollweg, Director

Student Activities/Memorial Union
Jeffrey S. Onore, Director

Student Affairs
J. Gregg Sanborn, Dean

Summer Session
Edward J. Durnall, Director

Thompson School of Applied Science
Lewis Roberts, Jr., Director

University Communications
Emily K. Smith, Director

Water Resources Research Center
Gordon L. Byers, Director

Whittemore School of Business and Economics
Dwight R. Ladd, Dean

Enrollment Statistics — Fall Semester

	1979-1980	1980-1981	1981-1982 (Men/Women—Total)	1982-1983
Freshmen	1151/1303— 2454	1087/1314— 2401	1031/1291— 2322	1068/1346— 2414
Sophomores	1117/1201— 2318	1151/1312— 2463	1103/1270— 2303	992/1242— 2234
Juniors	1057/1112— 2169	1070/1178— 2248	1074/1224 2298	955/1116— 2071
Seniors	1105/1135— 2240	1092/1138— 2230	1091/1223— 2314	1062/1344— 2406
1st Year—T.S.A.S.	193/ 107— 300	210/ 117— 327	205/ 127— 332	188/ 128— 316
2nd Year—T.S.A.S.	81/ 72— 153	84/ 64— 148	95/ 59— 154	93/ 72— 165
D.C.E.—A.A.	60/ 92— 152	67/ 107— 174	67/ 88— 155	39/ 68— 107
Graduates—Master's	370/ 352— 722	383/ 378— 761	359/ 393— 752	383/ 349— 732
Graduates—Doctorates	143/ 63— 206	140/ 67— 207	123/ 72— 195	110/ 67— 177
Total	5277/5437—10714	5284/5675—10959	5078/5747—10825	4890/5732—10622
Extension Credit Courses	673/ 999— 1672	673/ 992— 1665	568/ 813— 1399	630/ 811— 1441
Summer Session	1611/2051— 3662	n.a./ n.a.— 3290	1395/1814— 3209	1506/1796— 3302

		1979-1980	1980-1981	1981-1982	1982-1983	1979-1980	1980-1981	1981-1982	1982-1983
Baccalaureate Curricula		Life Sciences and Agriculture				Liberal Arts			
	Senior	402	395	401	392	751	738	764	811
	Junior	371	403	363	336	803	854	938	834
	Sophomore	339	354	377	322	1033	1208	1080	1078
	Freshman	304	397	348	320	1176	1080	1025	1049
	Total	1416	1549	1489	1370	3763	3880	3807	3772
		Engineering & Physical Sciences							
	Senior	443	437	472	456				
	Junior	399	415	395	359				
	Sophomore	434	392	370	355				
	Freshman	466	446	427	495				
	Total	1742	1690	1664	1665				
		Whittemore School				Health Studies			
	Senior	361	416	428	426	283	244	249	321
	Junior	374	349	344	282	222	227	258	260
	Sophomore	280	267	212	234	232	242	264	245
	Freshman	263	223	257	298	245	255	265	252
	Total	1283	1278	1241	1240	938	982	1063	1078
Graduate Curricula		Graduate School							
	†Master's	722	761	752	732				
	Doctorates	206	207	195	177				
	Total	928	968	947	909				
Associate Degree Curricula		Thompson School				Division of Continuing Education			
	2nd Year	153	148	154	165				
	1st Year	300	327	332	316				
	Total	453	475	486	481	152	174	155	107

† Does not include Institutes and Special Summer Session in Technology. Includes Certificates of Advanced Graduate Study.
n.a. not available

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